Productive Safety Net Program and Its Impact on the Livelihood of Rural Households in Doba District, Ethiopia

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Research Article

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Abstract

The Productive SafetyNet Program (PSNP) is a major political ingenuity by governments and donors that makes millions of chronically food-deficient rural populations safer and more predictable from ongoing food relief. So, we will move mainly to cash-based social protection. This study aims at examining major features of Productive Safety Net Program and its impact on the livelihood of rural households in Doba District, Ethiopia. A multi-stage sampling technique was used to draw 220 sample respondents from PSNP beneficiaries and non-beneficiaries. Household survey, focus group discussions and key informant interviews were employed to collect quantitative and qualitative data. Data were analyzed using Propensity Score Matching (PSM) and binary logistic regression model. Results revealed that PSNP increased total annual income by 39% and calorie intake by 8.4% of the PSNP participant households compared to non-participant households. PSNP has positive and statistically significant effect on food consumption and total annual income and on the livelihood of farming households. The logistic estimator also revealed participation in PSNP was significantly associated with variables such as cultivable land size, livestock holding, house roofing materials, distance from the extensions' office and access to credit service.

1. Introduction

Safety nets are a component of social protection aimed at combating poverty and the risks of poverty. Social Safety Net is a program that provides predictable and reliable support in the form of food, cash, or vouchers to people at risk of poverty, poverty, food insecurity, or other forms of deprivation (WFP, 2017). According to Subbarao et al. (1996) and Devereux (2002) cited in Khan et al. (2013), SafetyNet programs, in the form of in-kind benefits, or in cash or vouchers, by the public sector (government, donors, NGOs) or private parties (individual or group charities, informal budget agreements). Can be provided conditionally or unconditionally through.

Social safety nets had their earlier roots in Latin America (1980s) and Eastern Europe (1990s) which led the International Monetary Fund (IMF) and the World Bank (WB) to highlight the importance of social safety net as means to address vulnerable groups.

According to Rahman et al. (2011), the first money transfer program to the poor began during the Mexico crisis (tequila crisis) in 1994, the first conditional money transfer program in Brazil began in 1995 and has since been expanded to many countries. The interest and number of countries adopting safety net programs is increasing. Social safety nets are currently available to individuals and families in 131 developing and emerging countries (Banerji & Gentilini, 2013)

Chronic food insecurity is a decisive feature of poverty that has affected millions of Ethiopians over decades. Most poor households live in rural areas. Repeated droughts and their widespread consequences are a major cause of household food insecurity, as they rely heavily on rain management for their livelihoods. Since the famine of 198384, the policy response to the threat of food insecurity has been a series of urgent calls for food aid and other forms of emergency assistance. Daniel et al., (2009). They prevented widespread famine but were hit by drought and did not deplete the resources of disadvantaged families. As a result, the number of people in need of emergency food aid increased from about 2.1 million in 1996 to 13.2 million in 2003 and decreased to 7.1 million in 2004 (World Bank, 2004).

Recognizing this situation, the Ethiopian government "launched the Food Safety Program in 2003 and the PSNP officially launched in 2005" to address food insecurity from the government and funding providers. The program is one of the largest national social protection programs in Africa with a budget of approximately $ 650 million per year and operates in seven regions with 4,444 people, the most drought-prone districts, and benefiting at least eight million people during Phase IV (mid-2015–2020). The PSNP has specific features such as: types of transfers, specific objectives, basic principles, basic components, and targeting principles (Knippenberg et al., 2017).

The overall goal of this program is to address predictable food insecurity through the invention of int, which aims to enhance home resilience and adapt to various shocks. Taking these considerations into account, we support the continuation of the program, and based on the outcomes and experiences from the various PSNP phases, the final phase of the 2015–2020

Program (PSNP4) has been developed and "to the improved people". The intended result was "improved participation". Safety Net, Benefits and Nutrition of Food-Uncertain Households" (MoARD, 2015).

Regarding the program's targeting process, the PSNP uses a mixture of geographic and community-based concentrated to identify households built on chronic foods. First, Hugh Husherlevel focused on the PSNP, which focused on the selection of households, which had a high degree of food uncertainty, and these recipients from the past of food aid were in the past. The first selection with the help of the basic criteria that program developers then verify and refines and refines the selection of domestic households on the basis taken capacity of domestic life setting (assets and income) after. However, communities received considerable discretion to change this approach and update their lists of food-built households per year based on local criteria, which can give this opportunity for households, which suddenly become more gourmets due to a serious loss of assets and not in state Support itself is included in the recipient lists (Berhane et al., 2017).

The program offers cash, cereals, or a mixture of both in practice for public works. Chronic dishes in the lifetime / beneficiaries that cannot offer work for public works receive unconditional cash or food transfer from an equivalent value that contributes through work that contribute the households and increase the period of 6 to 12 months. The program includes two components: (i) the labor-intensive Public Work (PW) component, including Temporary Direct Support (TDS) receivers, and (ii) the Permanent Direct Support (PDS) component. Personal works of the beneficiaries accounted for 86% of the 8 million beneficiaries 2016/17. The public working component covers a large part of projects municipal level, and about 60 percent of it on recovery natural resources, such as soil and water protection, and designed climate resistance in Ethiopia (Haverkort et al., 2015).

Doba District is one of the seventeen targeted districts of West Hararghe Zone, defined as chronically food insecure due to its prior experience of food insecurity and food assistance. The PSNP started since 2005 in the district by targeting about 16,456 households. But currently, the number of beneficiary households increased to 35,245 within the 40 rural kebeles of the district. Of these, 82% of the beneficiaries were public works participants while 18% of them were direct support beneficiaries in addition to PSNP; 21,053 beneficiaries were supported by emergency program. This indicates that about 32% of the district populations were supported by PSNP and emergency food aid (WHANRO, 2019). Therefore, this study was done to identify major features and impacts of the PSNP on rural household food security of Doba district in which the PSNP has operating for the last fifteen years.

A growing literature is now available on the impacts of safety net program on the rural household's food security, particularly if they influence household's food consumption, income, and asset value. While some studies have been carried out on the impact of PSNP in Ethiopia at national level like Anderson et al., (2009) and at district level by Habtamu (2011), Tadele (2011), Yitagesu (2014), Nesreddin (2014) and Anwar (2015) on the impacts of the PSNP focused the impact on the livestock and tree holding, HH resilience, asset accumulation, sustainable land management, food security improvement at household level, reducing vulnerability.

Anderson et al. (2009), Habtamu (2011), Tadele (2011) state that the impact of PSNP on maintaining and accumulating assets was insignificant, but rather covers the hunger deficit. In addition, the results of studies by Yitagesu (2014), Nesreddin (2014) and Anwar (2015) show that PSNP plays a significant role in preventing wasting livestock, increasing household income, and reducing poverty through increased wealth accumulation. However, different scholars have done research on impacts of PSNP on household food security both at national and local level, there are limited empirical evidence whether the program efforts have the intended impacts on household food security particularly in the study area. The objective of this study is to assess major features and impacts of productive safety net program on the livelihood of rural households for the selected study area for the last 15 years since the program was launched.

2. Research Methods

2.1. Description of the study area

Doba district is one of the seventeen districts in West Hararghe administrative zone of Oromia National Regional State. The astronomical location of the district is between 9°10'0" N to 9°30'0" N Latitude and 40°55'0" E to 41°16'0" E Longitudes. It shares boundary with Chiro district on the south, Mieso District on the west, Somali Region in the north, East Hararghe zone in the east, and Tulo district in the southeast. The district covers a total area of 702.82 hectares and located at 382KM to the east of Addis Ababa, which is a capital city of Ethiopia, 45KM from Chiro, zonal capital of West Hararghe zone. The district has 40 rural *kebeles* administration and 2 town *kebele* administrations those are in different geographical features of agro-ecological zones (WHZPED, 2018). Doba District has a total population of 133,939 of which 68,512 (51%) and 65,427 (49%) are males and females respectively (CSA, 2007). The district's annual mean maximum temperature is computed as 25 °C, the annual average minimum temperature is 19 °C and the average of the two is found to be 22 °C and the annual rainfall of the district ranges from 559mm -1235mm (NMA, 2019). Doba District is found under Western Hararghe Agro pastoral Livelihood Zone. Rain-fed crop production is an important livelihood means in addition to livestock production (WHZANRO, 2019).

2.2. Research design and approach

This research study was conducted by employing the quasi-experimental design. This design also referred as non-experimental method and used to conduct an assessment when not possible to apply randomization (i.e., not possible to construct treatment and comparison group through experiment). According to Jalan and Ravallionn (2003) those projects that are introduced at large scale or national wide; it is common to only have access to a single cross-sectional survey done after the project is introduced. The study employed mainly mixed-method approach in collecting and analysis of quantitative and qualitative data.

2.3. Data Sources and Collection Methods

Data was collected from both primary and secondary sources. The data collected was both qualitative and quantitative. Primary data was collected from 220 selected respondents, the District Food Security Task Force, the Kebele Food Security Task Force, and key informants. Secondary data related to the survey was collected from various stakeholders, especially agricultural and natural resource offices in the district and region, and non-governmental organizations operating in the district. To complement the primary data, secondary data was also collected from a variety of sources, including reports from government officials, CSA, NMA, books, journals, and other sources. These sources should contain information related to this study. This study used household surveys, focus group discussions, interviews with valuable information, and document reviews to collect both quantitative and qualitative data.

2.4. Sample size and sampling procedure

Doba district was selected purposively due to its chronically food insecurity, higher number of caseload and many years of support provided through the emergency and safety net program, based on annual report of (WHANRO, 2018), Then following a stratified random sampling technique was employed to select three kebeles and a total of 220 (110 PSNP participant and 110 PSNP Non-participants) households was selected using proportionate random samples by employing formula of Cochran, (1963) developed the Eq. 1 to yield a representative sample for proportions. He proposed a correction formula to calculate the final sample size in this case, which is given below:

$$\text{no} = \frac{Z^2 pq}{e^2} \quad \text{----------(1)}$$

$$\text{n} = \frac{n_o}{1+\frac{n_o-1}{N}} \quad \text{---------- (2),}$$

2.5. Methods of data analysis

This study used both descriptive statistics and econometric models to analyze the key characteristics and impacts of productive safety net programs on the livelihoods of rural households. The fundamental problem with quantitative impact assessment of programs like PSNP is that you can only observe what is happening to the beneficiaries. A person who does

not pay attention to what happens to the same household if they are not receiving benefits. This is called the counterfactual problem. The second issue is selection bias. Selection bias occurs when beneficiaries are systematically different from non-beneficiaries. Researchers' ability to predict the causality of PSNP depends on how well they can address both problems (Berhane et al., 2017). Therefore, this study used the propensity score matching (PSM) method. This is currently the most widely used matching method when assessing the impact of a program. PSM uses a completely nonparametric method to estimate the outcome model. The statistical software STATA version 13 and SPSS version 20 were used for data analysis, coding, and input to ultimately quantify the empirical results of this study.

2.5.1. Propensity Score Matching (PSM) Method

In current programs for assessing efficacy, PSM is one of the most frequently used methods when there is no baseline survey, and it is not possible to randomly assign treatment to testers. PSM refers to a combination of treatment and control groups with similar propensity scores and possible covariates (Rubin, D.B., 2001). The dependent variable of interest in this study was participation in the program. It is essentially binary in that it takes values of 1 and 0. To assess the impact of the intervention, it is necessary to draw inferences about the outcomes that would have been observed if the participants had not participated in the program. To properly assess the impact of the program, determine the average therapeutic effect (ATT) on the treated household, which is defined as the difference in outcome variables between the treated household and its counterfactual household. is needed. According to Rosenbaum (2002), counteracts are what happened to the program participants' outcomes if they did not participate in the treatment. In case of binary treatment of the program the treatment indicator D_i equals if individual i receives treatment and zero otherwise. The potential outcomes are then defined as: Y_i (D_i) For each individua i, where i = 1, 2……n, then the treatment effect of individual i can be articulated as:

(1) T_i = Y_i(1) − Y_i(0)
Estimating individual treatment effect is not possible. Therefore, Average (population) treatment effect on the treated (ATT) is developed which specified as:

(2) T_{ATT} = E (T\D = 1) = E [Y (1) \ D = 1] – E [Y (0) \ D = 1]
Therefore, the counterfactual mean for those being treated represented as:

□ E [Y (0) │D = 1]

(3) ATT = E [Y (1) \ D = 1] □ E [Y (0) \D = 1] = T_{ATT} + E [Y (0) \D = 1] □ E [Y (0) \D = 0]
T_{ATT} Is so-called 'self-selection bias' then the true parameters of A_{ATT} is only identified if

(4) E [Y (0) \D = 1] □ E [Y (0) \D = 0] = 0
(5) A_{ATT} = E [Y (1) □ Y (0)]
Common support region given by:

(6) (overlap) 0 < p (D = 1\ X) < 1
Lastly the general PSM model specified as a fallow:

(7) A_{ATT} = Ep(x) │D = 1{E [Y (1) \ D = 1, p(x)] □ E [Y (0) \ D = 0, p(x)]}
Therefore, ATTs is simply the mean difference in outcomes over the common support, appropriate weighted by the propensity score distribution of participants

2.5.2. Binary Logit Model Specification

Adopting from Gujarati, D.N. (2004) the logistic distribution function for the determining factors in livelihood status of the households is specified as follows:

(8) p_i = E (y = 1|x1) = $\frac{1}{1+e^{\beta 0+\beta 1x1}}$

Equation (1) can be simplified as:

(9) p_i = $\frac{1}{1+e^{-zi}}$

The probability that a given household is affected by PSNP participation (participant) is expressed by Eq. (2) while, the probability for not being affected (non-participant) is:

(10) 1 − p_i= $\frac{1}{1+e^{zi}}$

Therefore, the odds ratio can be written as:

(11) $\frac{p(i)}{1-p(i)}$ = $\frac{1+e^{z(i)}}{1+e^{-z(i)}}$ = e^{zi}

Now (Pi/1-Pi) is simply the odds ratio in favor of participating in PSNP; the ratio of the probability that a household would be influenced by the program to the probability of that they are not influenced. Finally, taking the natural logarithms of the odds ratio of Eq. (4) would result the logit model as indicated below.

(12) Li = ln $\left(\frac{p(i)}{1-p(i)}\right)$ = ln [e^{zi}] =z_i

Where: Z i = is a function of n explanatory variables (Xi) which is also expressed as:

(13) z_i = $\beta o + \beta 1x1 + \beta 2x2 + \ldots\ldots\ldots \beta nXn$

Where: β0, is an intercept, β1, β2... βn are slopes of the equation in the model. Li is log of the odds ratio, which is not only linear in X but also linear in the parameters. Xi is vector of explanatory variables. Finally, disturbance term I which is unobserved factors are considered and the logit model becomes:

(14) Zi =$\beta 0 + \beta 1x1 + \beta 2x2 + - - - - - - - - + \beta nXn + \mu i$

2.6. Description of variables

Table 1

3. Results And Discussion

3.1. Socio-demographic characteristics

Sex of the household head: The result in Table 2 shows that about 23.6% and 76.4%from beneficiaries and 33.6% and 66.4% of non-beneficiary households were female and male-headed households respectively. In line with this, from the total respondents, 71.4% and 28.6% of the sample farmers were male and female-headed households respectively. Therefore, sex is statistically insignificant (p = 0.13) and negative relationship with the participation in PSNP with χ2 = 4.01 this implies that, there is no statically significant difference between participants and non-participants in terms of sex of the household head. This result was similar with the results obtained by Abiyot (2012), reported, as sex has no relation to the participation in the PSNP program.

Age of the household head: According to the result presented in Table 3 the mean age of the sampled households was 41.05 and the mean age of the participant and non-participant household was 41.05 and 41.04 years respectively. The age difference between participant and non- participant was found to be in significant (p = 0.99) with the t-value (t = 0.01), which is different with the hypothesized relationship with participation. The result is consistence with the research finding by Mesfin

(2018), reported, as there is no significant difference in age of the household head between PSNP participant and PSNP Non-participant

Family size: The results in Table 3 show that the sample household has an average family size of 7, a maximum family size of 12, and a minimum family size of 2. The average family size of beneficiaries was 6.0, and the average family size of non-beneficiaries was 6.4. However, non-beneficiary households appear to be larger than beneficiary households. The results showed a statistically significant difference in mean family size ($p = 0.1466$) and t-value ($t = 1.45$) between participants and non-participants. This is different from the virtual relationship with participation. This result is consistent with the findings by Mesfin (2018), who reported that there was no significant difference in family size of heads of household between PSNP participants and non-PSNP participants.

Dependency ratio: The dependency index is influenced by the size and age structure of the family. Participants had an average dependence index of 2.54, non-participants had an average dependence index of 2.81, and a mean difference of 0.27. This means that non-beneficiary households have more dependents (family members under the age of 15 and over the age of 65) than beneficiary households. Statistical analysis showed that there was a statistically significant difference (significance level 10%) between participants and non-participants in terms of dependent ratio (see Table 3).

Educational Level of household head: According to the survey results in Table 4, 34.5% and 40.9% of beneficiaries and non-beneficiaries could not read and write, and 16.4% and 14.5% of beneficiaries and non-beneficiaries could read and write, 42.7%. And 35.5% of beneficiaries and non-beneficiaries are in the primary and lower secondary levels up to 8, 7% and 9%, beneficiaries and non-beneficiaries of upper secondary levels 9–12, and 12 classes or more of non-beneficiaries. It was 0.9% of the people. The results showed a statistically non-significant difference in the level of education of participants and non-participants. The results are consistent with the Mesfin (2018) survey, as there is no significant difference in the level of education of heads of household between PSNP participants and non-PSNP participants.

Land holding: According to the survey results in Table 5, the average land ownership / ownership size of the sample households was 0.39 ha. The maximum land size owned by the sample households was 1.5 hectares and the minimum land size was 0 hectares each. As a result, the average land ownership of participating households was 0.33 hectares, and the average land ownership of non-participating households was 0.45 hectares. The p-value results show that the mean difference between the two sample groups for land borehole size is 1%, which is statistically significant. Participating households own less land than non-participating households. This result is consistent with the findings of Nesreddin (20014) and Anwar and Mada (2015).

Livestock holding: Livestock populations in the sample households range from 0 to 9.35 TLU, suggesting differences in livestock between households. The average livestock TLUs in the participating and non-participating sample households were 1.76 and 3.24 TLU, respectively. The results of this study showed that the mean difference in livestock farms for TLU between PSNP-participating and non-PSNP-participating households was positive and significant. The p-value also showed that this difference was statistically significant with a 1% chance. This is consistent with its virtual relevance to participation. This shows that increasing or decreasing the size of livestock in households has had a significant impact on participation in the PSNP program. This result is consistent with the findings of Nesreddin (20014), Anwar and Mada (2015) (see Table 5).

Distance from the Development Agent Office: The average distance to the DA offices of the surveyed households was 2.634 km. According to the results shown in Table 5, participating households averaged 3.09 km away from the development agency's office, and non-participating households averaged 2.17 km away. The distance to the development agent's office in the sample household is 0.1–5.5 km. Farmers in the study area travel an average of 2.6 km to reach the development agent's office to access improved agricultural advisory services. Participating households traveled an average of 3.1 km and non-participating households traveled an average of 2.2 km, arriving at the development agency's office to improve agricultural advisory services. As a result of this study, the difference in the distance between PSNP households and non-PSNP households to the counseling center was found to be positive and significant on average. The p-value also indicates that

there is a 1% chance that this difference is statistically significant. This corresponds to virtual pooling with participation. The results are consistent with those of Anwar (2015) and Mesfin (2018) (see Table 5).

Access to fertilizer use: Approximately 74.5% of all households in the sample have access to fertilizer. Regarding access to fertilizer use within the group, approximately 70.9% came from beneficiaries and 78.2% came from non-beneficiary households. Statistical analysis shows that non-beneficiary households have more access to fertilizer use than beneficiary households, but there is no statistically significant difference in access to fertilizer use between participants and non-participants. (See Table 6).

Access to Improved seed: Approximately 35.4% of all households in the sample have improved seeds available. Regarding improved seed access within the group, approximately 27.3% came from beneficiaries and 43.6% came from non-beneficiary households. Statistical analysis showed that this difference was statistically significant with a 5% chance, and that non-beneficiary households had more access to improve seed use than beneficiary households. The results are consistent with the findings from Anwar (2015) and Mesfin (2018) (see Table 6).

Type of roof: According to the results of the finding presented in Table 6, 30.9% (34 HHs) of the PSNP participants were living in a grass thatched house and this figure drops to 9.1percent (10 HHs) for non-participant households. The statistical analysis shows that this difference was statistically significant at 1% probability level, which is the same as the hypothesized relationship with participation. The majority of targeted HHs by PSNP program was living in grass thatched houses. About 90.9% of the non-participants HHs were living in corrugated iron sheet house whereas this figure drops to 69.1% for participant HHs. The type of the roof built is tells a story about the wealth status of a given household and Owning of a house covered with corrugated iron sheet is hypothesized as negatively correlated to being a member of safety net beneficiaries. The result is consistence with the research finding by Anwar (2015)

Access to credit service: Of the total number of respondents, only 16.36% of households in the survey area participated in the loan service. Of the households with program beneficiaries, 18.2% used the loan service and 14.5% of the non-program household respondents used the loan service. The results show that there is no statistically significant difference between participating and non-participating households in terms of access to credit services. The results are consistent with the findings from Mesfin (2018) (see Table 6).

Access to Extension Service: As stated in Table 7, from the total of sample respondents, about 93.6% of the households receive extension service, among the program beneficiary households 92.7% and 94.5% of non-participant sample households were visited by development agents (DAs) in the year 2019. This indicates that, the continuous observation of their food insecurity status by the extension workers has made the participant group to be known as food insecure households since these development agents were constant members and main actors in the targeting and screening of PSNP participant. Access to Extension Service had statistically insignificant difference between program participant and non-participant households (See Table 6).

3.2. Household Income and Consumption

The Survey result in table 7 shows that the mean annual income is Birr 17049.94. Mean total annual income for PSNP participants was 18581.05 birr and 15518.82 birr for non-PSNP participants respectively, with the mean difference of 3062.236 birr. It means that beneficiaries' households have more annual income than non-beneficiary households. The t-test ($t = 3.24$) indicates that the two groups are significantly different at 1% probability level in terms of their annual income ($p = 0.0014$). The result is consistence with the research finding by Tsegaye (2017). The survey result also shows that the daily kilocalorie intake of sample households is ranging from 1347 to 4594. The participant and non-participant households had an average calorie intake of 2390.027 and 2300.618 kilocalories, respectively while the average calorie intake of the total sampled households was 2345.323 kilo calories. This means that households in the program are better off in terms of calorie intake. The t-test ($t = 1.8$) indicates that the two groups are significantly different at 10% probability level in terms of

mean calorie intake (p = 0.0782) The result is consistence with the research finding by Nesredin (2014) and Abduselam (2017) but contradicted with Mesfin (2018) (See Table 7).

3.3. Major Features of PSNP in the study area

3.3.1. Description of the Productive Safety Net Program in the study area

PSNPs have unique attributes such as core components, types of transfer, specific goals, essential and aiming standards. This program has three components. livelihood, direct support, and social service components. Service components include training in marketing, business and value chain, and preparation of an effective business plan for referral to microfinance institutions. The other two components provide cash and grain/cash or grain only to PSNP beneficiaries. The payment was 5 ETB at the start of the program and has increased to 42 ETB per person per day since 2016 in the county. The criteria for selection of beneficiaries in the district confirmed by food security target groups show community selection according to asset class and social status (especially the lowest social status according to the level of well-being) (MoARD, 2014).

90% of PSNP beneficiary households, apart from two factors, are labor-intensive activities such as income-generating activities, soil and water conservation measures in commons, tree planting, fences, and construction of schools, construction of access roads, provision of local raw materials to buildings. PSNP is complemented by additional food security programs within the district. PSNP cards are usually given to PSNP beneficiary households. The loan is intended for beneficiary households who purchase various livelihood / investment packages such as livestock production, incineration of agricultural inputs, tools, and technologies for terminal activities as part of their business plan (WHANRO, 2019).

a) PSNP targeting

The survey results of respondents regarding the fairness of targeting reveal that 75% and 36% of PSNP beneficiary and non-PSNP beneficiary respectively, confirmed that the targeting was fair, while 25% and 64% of program beneficiaries and non-program beneficiaries respectively respond that the targeting was unfair. Besides, non-PSNP beneficiary households believed that they need to be considered to participate in the PSNP and they mentioned that the allocated resources were not sufficient, and few peoples were also targeted without fulfilling the criteria and because of this peoples that need to be supported by the program were excluded (See Table 8).

The result from the focused group discussion conducted with key informants in Dalota, Lega-Lencha and Meda-Bilisuma kebeles show that targeting of PSNP was not according to program implementation manual, the manual says targeting households should be poor of poor, low land size but most the safety net program clients were not fulfilling the above-mentioned criteria.

On the same way focused group discussion conducted with the WFSTF, KFSTF and key informants revealed that the resources allocated to the district was not sufficient to address all the food in secured HHs and due to this some of the households can be excluded from the program and they were triad to correct the issues of targeting error with community, however the problem of targeting were the issue that needs attention yet.

The result is consistence with the research finding by Fekadu (2009), Welteji (2017) and Semma (2020).

b) Appeals management mechanism

The survey results of respondents revile that 19 (17.35) and 42 (35%) household from PSNP beneficiary and non-PSNP beneficiary respectively they were appeal for the KFSTF about the problem of selection to get solution and they were not got response or solution regarding targeting decision.

The result from the focused group discussion conducted with key informants in kebele, the respondents were asked to introduce the appeal request and management system and highlighted that "There were no appeal systems to tell our problems regarding the program apart from kebele level, when we go to the higher levels districts (District, zones).

The result is consistence with the research finding by Fekadu (2009) and Samuel (2020).

c) Payment modality

Survey results of program beneficiary on mode of payment indicate that 100% of payments were covered by cash. On what mode of transfer participants prefer, 16.4%, 60% and 23.6% of the households indicate that they prefer cash only, grain only and half grain and half cash respectively. About 60% or more than half of program participant express that, therefore, to grain than cash because the grain can fulfill their need and the price of grain higher than the cash they receive (See Table 9).

Results of focus group discussions held with KFSTF and Key informants in kebele, the discussant were raised that the amount of cash transfer (forty-two birr/day/person) is too little and cannot support the consumption level of the households. Other concerns rose due to the revision of (PIM 2014), five family caps were implemented, and this made that those families targeted with all their family members were reduced to five family members only. This made that the households with high family members receive only the little amount of cash, which cannot support their households. It is also noted that the payment was not made as per stated on PIM/ not on time.

D) Graduation

The survey results of respondent households on awareness on program and perception on graduating from the program reveals that 98 (89.1%) of the households they were aware and had information about graduation and about and 12(10.9%) of the beneficiaries respond that they were not have information regarding graduation from the program. On the other hand, the result of survey on the perception of the beneficiary household graduation from the program show that, 18 (16.3%), 89(81%) and 3(2.7%) of households express their view that Support, Oppose and No response respectively. The result is consistence with the research finding by Berhane (2013) (See Table 10).

Results of focus group discussions held with KFSTF, DFSTF and Key informants in kebele and district, the discussant were raised were asked to respond that their feelings to graduation and noted that actually the livelihood of beneficiary households were changed after they joined the PSNP, they were not interested to graduate from the program due to recurrent natural shocks, low/no access to credit and low saving cultures, as well as lack of continuous technical supports from line sectors in order to encourage program participants to attain the sated graduation bench mark. On the other hand, households those accumulate the asset attained the benchmark of graduation were not interested to graduate from the program and KFST were not correctly screening those attain the benchmark and dependency syndrome were developed on both PW beneficiaries and KFSTF.

3.4. Socio- Economic Impacts of PSNP

3.4.1. Social impacts of PSNP

One of the objectives of Productive Safety Programme is to see all Ethiopians enjoy social and economic well-being, security, and social justice. According to the respondents emphasized that PSNP helped them to participate in social community events such as funeral, become ordinary and committee members in different formal institutions like, Farmers Cooperatives, Rural saving and credit Association and irrigation water user association and informal institutions like (*Afosh/Ider*, *Guza/Faraqa*) in addition to this they got a chance to participate in a kebele meeting. The lion shares of the PSNP participants replied that they become ordinary members while only closer to 5% committee members since they joined the program (Table 11). Moreover, as they replied PSNP created a capacity to build social equity, reduced social discriminations and helped the households to participate with different social aspects through increasing social inclusion of poor households to the society. The result is consistence with the research finding by Samuel (2020).

3.4.2. Economic impact of PSNP

3.4.2.1. Economic impact at Household level

a) Impacts of PSNP participation on household's food security

In this study, household's calorie intake per adult per day was used to identify the food secure status households. As a result, obtained from all sampled households, 78 (71%) and 32 (29%) of PSNP and 60 (54.5%) and 50 (45.5%) of non-PSNP households were food secured and food in-secured/ unable to obtain the minimum recommended energy level for healthy and productive life. This indicates that PSNP beneficiaries gain more Kcal than non-PSNP beneficiaries due to their participation on PSNP program (See Fig. 1).

b) Impacts of PSNP participation on annual income

According to the result in (Table 12), the majority of PSNPP beneficiary's household income/standard of living is improved and improved a lot due to the intervention of PSNP. This implies that safety net payment has immense economic opportunity for poor households to sustain their lives. The result is consistence with the research finding by Welteji (2017) and Samuel (2020).

c) Impacts of PSNP participation on asset accumulation

Targeting to productive safety net program made them an opportunity to fulfill their essential home using equipment's and livestock. According to this study, PSNP has made changes in accumulation of livestock and improve the livelihood poor households. The result is consistence with the research finding by Anwar (2015), Welteji (2017) and Samuel (2020) (See Table 13).

d) Impacts of PSNP participation on financial literacy

The beneficiaries were trained about financial planning and budgeting, saving and its importance, how to calculate the profits, increased the understanding about credit. Most the PSNP beneficiaries were expressed that since they joined the program, they acquired knowledge and basic skill that improve their way of thinking and doing their business. In general training is one the biggest opportunity to the poor households to change their livelihoods. The result is consistence with the research finding by Samuel (2020) (See Table 14).

3.4.2.2. Economic impacts of PSNP at community level

Productive safety net program has an objective of rehabilitating the community by constructing community-based projects which are the planned and prioritized by the community. This study analyzed the capital budget performances of the Doba district during the five years from 2015/16-2019/20. Accordingly, a total of 28 projects with a total cost of 19,249,838 Birr were constructed and benefiting the community. The result is consistence with the research finding by Welteji (2017) and Samuel (2020).

Focus Group Discussion and Key Informant discussion held at Kebele and District level show that, the projects were prioritized and planned with community and creates uncountable economic and social benefit to the rural community at large beyond the PSNP beneficiary household.

The table 15 shows the integrated community-based projects built by the Productive Safety Net Program. This can be seen as good economic opportunity that fundamentally helps the community in the Doba districts.

3.4.3. Econometric result of PSNP impact

To examine the impacts of PSNP on rural household's Livelihood, Propensity Score Matching (PSM) model was deployed.

3.4.3.1. Propensity scores estimation

3.4.3.2. Imposing common support region

After the propensity score is estimated, a widespread support area should be applied to the propensity score distribution for households with and without the program. This is the range that includes the minimum and maximum slope ratings for households participating in PSNP and those not participating in PSNP. As shown in Table 20, the estimated propensity score fluctuates between 0.0440871 to 0.996478 (mean = 0.7124228) in treated households (PSNP participants) and 0.0022698 to 0.8959153 (mean = 0.2875772) in control households (PSNP non-participants). To do. The common support area is between 0.0440871 and 0.8959153. In other words, households with an estimated gradient value less than 0.0440871 and greater than 0.8959153 were excluded from the allocation exercise and removed from the sample. As a result of this common support condition limitation, 22 of the 220 sample households that did not participate in PSNP were removed due to this limitation. This indicates that we did not exclude households benefiting from PSNP from the sample when calculating the impact estimates.

Distribution of estimated trend assessments for programmed and non-programmed households with and without common support conditions. Most households with PSNP participants have a propensity score of over 0.896, while the majority of non-PSNP households have a propensity score of about 0.04 (see Fig. 2).

3.4.3.3. Choice of matching algorithm

3.4.3.4. Testing the balance of propensity score and covariates

Best Estimated Kernel Bandwidth 0.25 Selected Match Test Quality Estimates. The results in Table 19 show that the pre- and post-matching covariate equalization tests showed significant differences in preventive variables with respect to age, access to counseling services, access to credit services, and distance to the counseling center. increase. However, no differences were observed after the matching process.

3.4.3.5. Treatment Effect on Treated

The estimation results shown in Table 20 below provide evidence to support the impact of the program on household food security. The following impact indicators of therapeutic efficacy were selected to achieve the goal of measuring the effect of PSNP on household caloric intake, which is an important substitute for food security status and household total annual income. It is possible to use the PSM model already mentioned to run one of the algorithms. The estimation results show that there is supporting evidence that the outcome variables have a statistically significant effect. Therefore, PSNP Participants (1) household Caloric Intake in Kcal / AE / day food intake, the program was found to increase the average caloric intake of households participating in PSNP by 185.79 Kcal / day, which is AE 8.4% higher than PSNP non-participants. The results are consistent with the findings of Nesreddin (2014), Anwar and Mada (2015), Abduselam (2017) and Andualem and Zerhun (2020), (2) households participating in PSNP have achieved an average annual income of 5218.63 bulls, which is about 39% higher than households not participating in PSNP. The results are consistent with the findings of Nesreddin (2014), Mada (2015) and Zerihun (2020).

4. Conclusions And Recommendations

This study aimed at examining features of PSNP and its impacts on the livelihood of rural farming households at Doba district, Ethiopia. To this end, both descriptive statistics and econometric techniques (PSM) were used to analyze experimental data collected from treatment and control groups in the study area. Results revealed that there is a statistically significant difference in socioeconomic characteristics such as gender, dependency ratio, size of land ownership, number of livestock, access to improved seed and type of corrugated iron roof between participants and non-participants of PSNP. However, the test was statistically not significant with respect to age, family size and education level, access to agricultural

extension and access to chemical fertilizers. The results of the logit model also showed that program participation is strongly influenced by a combination of factors. For instance, households in the program where more likely to have small land size, small number of livestock, housing, distance to extension office and access to credit service. The study findings show that, the level of annual income and household calorie consumption per day per AE of the PSNP participants are 39% and 8.4% higher than that of PSNP Non- participants' households respectively. The study concludes that, participant households were more likely to be food secured as compared to the non-participant households. Therefore, based on the empirical findings of the study, around five policy recommendations were forwarded. First, the dependency ratio and average family size of households participating in the program are higher than the regional averages, indicating the need to focus on integrating family planning programs. Therefore, the responsible agency needs to review the implementation of the family planning program in the district to integrate it with the PSNP programs. Secondly, the number of targeted households to be supported by the program was not sufficient with the existing number of foods in secured households in the study area. Therefore, targeting process should be implemented according to program implementation manual. The Payment modalities of the program participant should be demand based on time and sufficient. The district and zonal level authorities must oversee the payment performance on the time and must take a corrective action. Fourthly, the responsible body should graduate households from the program those attain the graduation bench to give chance to other households. On the other hand, to increase the rate graduation of program participant households, a pre-planned way of linking with livelihood projects, increase access and loan size, frequent technical support; monitoring and evaluation should be strengthened at District and zonal level. The appeal management system should be strengthened. In addition, the role of the variables indicated above should be reflected in the selection of participants to achieve the desired impact in similar contexts. By and large, further research is required with larger sample size (more than one cross-sectional data) to understand the wider impacts of the program.

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Declarations

Competing interests:

The authors declare no competing interests.

Tables

Table 1. Variables Definition and Description used in PSM analysis

Variable	Type and definition	Measurement
Dependent variables		
TYPEOFRESPONDENT	Dummy, participation in PSNP	1 if yes, 0 otherwise
Outcome Variables		
HHCALORICONSUMTION	Continuous, calorie intake in AE	Calorie
TOTALINCOME	Continuous, Total income of the HH	Birr
Independent variables (Pre- intervention)		
AGEHHH	Continuous, age of the household head	Years completed
SEXHHH	Dummy, Sex	1 if the HH is Male and 0, otherwise
EDUHHH	Dummy, Education level of the HH	1 if the HH is literate and 0 otherwise
FAMILYSIZE	Continuous, Family size	Number of household members
DEPRATO	Continuous, dependency ratio	Ratio
TOTALLAND	Continuous, Land holding size of the household	Hectare /*Timad (Qindii)*
TOTALTLU	Continuous, Livestock holding	Tropical Livestock Unit (TLU)
CHEMIFER	Dummy, Fertilizer use of the HH	Take the value of 1 if the HH is using and 0 otherwise
IMPRVEDSEED	Dummy, improved seed Use of the HH	1 if the HH is using and 0 otherwise
HOUSING	Dummy, Pre-intervention house type	1 if corrugated,0 otherwise
ACCESSTOEXT	Dummy, access to extension	1 if a household has access to extension and 0 if not
DISTOEXTSERVICE	Continuous, distance from the Extension Service	Kilo meter
ACCESSCREDIT	Dummy access to credit	1 if a household uses credit service and 0 if not

Table 2. Sex of respondent Household heads

Description of variables	Categories	Type of respondent						χ2 -value	p-value
		PSNP Participant		PSNP Non- Participant		Total			
		Frequency	%	Frequency	%	Frequency	%		
SEXHHH	Male	84	76.4	73	66.4	157	71.4	4.09	0.129
	Female	26	23.6	37	33.6	63	28.6		

Source: Own survey data, August 2020

Table 3. Age, Family size and dependency ratio of Household head

Variables	Total HHs		PSNP Participant		PSNP Non-Participant		t-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
AGEHHH	41.05	9.03	41.05	8.59	41.05	9.48	0.01	0.9941
FAMILYSIZE	6.22	2.13	6.01	2.21	6.43	2.04	1.45	0.1466
DEPENDENCYRATIO	2.67	1.18	2.54	1.16	2.81	1.18	1.72	0.0863*

Source: Own survey data, August 2020.

Table 4. Educational level of household head

Description of variables	PSNP Participant		PSNP Non-Participant		Total		χ2 - value	P-Value
	N	%	N	%	No	%		
Cannot read and write	38	34.5	45	40.9	83	37.7		
Can read and write	18	16.4	16	14.5	34	15.5		
Grade 1 to 8	47	42.7	39	35.5	86	39.1	2.702	0.609
Grade 9 to 12	7	6.4	9	8.2	16	7.3		
Above Grade 12	0	0	1	0.9	1	0.5		
Total	110	100	110	100	220	100		

Source: Own survey data, August 2020.

Table 5. Household Total land holding, Total Livestock (TLU) and Distance to extension office.

Variables	Total HHs		PSNP Participant		PSNP Non-Participant		t-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
TOTALLAND (ha)	0.39	0.25	0.33	0.254	0.45	0.28	3.69	0.0003***
TOTALTLU (TLU)	2.5	2.1	1.76	1.84	3.24	2.1	5.58	0.0000***
DISTTOEXTOFFICE(KM)	2.63	1.68	3.09	1.38	2.18	1.84	4.17	0.0000***

Source: Own survey data, August 2020. N.B: *** means significant at 1% probability level.

Table 6. Households access to Chemical Fertilizer, Improved seed, Extension, Credit and house type.

Description of variables	Categories	Type of respondent				χ2 - value	p-value
		PSNP Participant		PSNP Non-Participant			
		Frequency	%	Frequency	%		
Access to Chemical Fertilizer	Yes	78	70.9	86	78.2	1.53	0.139
	No	32	29.1	24	21.8		
Access to Improved Seed	Yes	30	7.3	48	43.6	6.44	0.008**
	No	80	72.7	62	56.4		
Access to Credit	Yes	20	18.2	16	14.5	1.58	0.454
	No	90	81.8	94	85.5		
Access to Extension Service	Yes	102	92.7	104	94.5	0.31	0.392
	No	8	7.3	6	5.5		
Housing	Grass	34	30.9	10	9.1	16.36	0.000***
	Corrugated iron sheet	76	69.1	100	90.9		

Source: Own survey data, August 2020. N.B: *** and ** means significant at the 1% and 5% probability levels, respectively.

Table 7. Household total annual income and Calorie available per AE in (Kcal) per day

Variables	PSNP Participant		PSNP Non-Participant		Total		MD	t-Value	p-value
	Mean	SD	Mean	SD	Mean	SD			
Total Annual Income (Birr)	18581.05	6836.65	15518.82	7183.38	17049.94	7162.46	3062.24	3.24	0.0014***
Calorie available per AE in (kcal)	2390.027	434.71	2300.62	303.086	2345.32	376.54	89.41	1.8	0.0782*

Source: Own survey data, August 2020. N.B: *** and *, means significant at the 1%and 10% probability levels, respectively.

Table 8: Communities perception on the fairness of targeting beneficiaries

	Response	PSNP participant		PSNP Non- participant		Total	%
		No.	%	No.	%		
Is selection being fair	Yes	81	75	36	36	117	56.2
	No	27	25	64	64	91	43.8
	Total	108	100	100	100	208	100

Source: Own survey data, August 2020

Table 9: Payment modality and preference of beneficiaries HH

	Mode of payment in 2019/20		Payment preference of beneficiary HH	
	Number	%	Number	%
Cash only	110	100	18	16.4
Grain only	-	-	66	60
Half grain and half cash	-	-	26	23.6
Total	110	100	110	100

Source: Own survey data, August 2020

Table10: Awareness and perception of HH on graduation from PSNP

	Response	Total	%
Do you have awareness on graduation from program	Yes	98	89.1
	No	12	10.9
	Total	110	100
How do you view graduation from the PSNP program			
	Support	18	16.3
	Oppose	89	81
	No response	3	2.7
	Total	**110**	**100**

Source: Own survey data, August 2020

Table 11: Social status/position in any formal or informal organization /association

	PSNP Participant		PSNP Non-Participant		Total	%
	N	%	N	%		
Ordinary member	99	95.2	106	100	205	97.5
Committee member	5	4.8			5	2.4
Total	104		106		210	100

Source: Own survey data, August 2020

Table 12: Is PSNP improving your income/standards of living?

	PSNP Beneficiary HH	
	Number	%
Not improve	7	6.4
Not sure	3	2.7
Improve	68	61.8
Improve a lot	32	29.1
Total	**110**	**100**

Source: Own survey data, August 2020

Table 13: Households acquired new household assets

	PSNP Beneficiary HH	
	Number	%
Yes because of PSNP	41	37.3
Yes, for other reason	5	4.5
No	64	58.2
Total	110	100

Source: Own survey data, August 2020

Table 14: Doba district financial literacy training activities performed from 2017 to 2020

Fiscal year	Activity	Number of PSNP clients participated						Percent achievement versus plan
		Plan			Achievement			
		M	F	T	M	F	T	
2017	Financial literacy training	1250	1250	2500	474	302	776	31
2018	Financial literacy training	1100	1100	2200	675	1155	1830	83
2019	Financial literacy training	1000	1000	2000	806	1644	2450	123
2020	Financial literacy training	300	300	600	300	300	600	100

Source: WHZANRO, 2020

Table 15: Community based projects built by PSNP

Types of Projects	Unit	Quantity	Capital Budget allocated (Birr)	Project performance %
Farmers Training Center	No.	2	1,330,000	97
Development Agent House	No.	2	1,909,401	100
Veterinary Health Post	No.	3	1,905,032	99
Additional Classroom	No.	3	1,728,402	100
Warehouse	No.	3	2,065,032	100
Spring Development	No.	5	3,168,827	100
Small Scale Irrigation	No.	1	647,580	100
Irrigation Canal Construction 7km	No.	3	2,200,027	100
Drinking water expansion 2km	No.	2	1,634,002	100
Night Storage Pond with 300M^3	No.	2	541,535	100
Pond (18501 M^3)	No.	2	2,120,000	100
Total		**28**	**19,249,838**	

Source, Doba District ANRDO, 2020

Table 16: Results of the Logistic Regression Model

Participation	Coefficients	Std. Err	Z values	P- value
AGEHHH	.0174159	.0124552	1.40	0.162
SEXHHH	.1963319	.2631665	0.75	0.456
EDUHHH	.4723398	.2638091	1.79	0.073*
FAMILYSIZE	-.015881	.0573377	-0.28	0.782
DIPENDCYRATIO	-.33823	.1277362	-2.65	0.008**
TOTALLAND	-1.141492	.5491791	-2.08	0.038*
TOTALTLU	-.2612097	.0598635	-4.36	0.000***
CHEMICALFERTLIZER	-.1752716	.2762005	-0.63	0.526
IMPROVEDSEED	-.0192438	.2539833	-0.08	0.940
HOUSING	-.8762617	.2863639	-3.06	0.002***
ACCESSTOEXT	.5186559	.4022539	1.29	0.197
ACCESSTOCREDIT	.9507699	.2140767	4.44	0.000***
DISTANCETO EXT.OFFICE	.310707	.0734215	4.23	0.000***
_cons	.081147	.7635733	0.11	0.915
N	220			
LR chi2 (13)	110.38			
Prob> ch2	0.0000			
Log likelihood	-97.30233			
Pseudo R2	0.3619			
Count r2				

Source: Own estimation result, August 2020 **N.B:** ***, ** and * means significant at the 1%, 5% and 10% probability levels, respectively.

Table 17: Distribution of Sample Households by Estimated Propensity Scores

Group	N	Mean	Std.	Min.	Max.
Total Households	220	0.5	0.3255677	0.0022698	0.996478
Treated Households	110	0.7124228	0.2475616	0.0440871	0.996478
Control Households	110	0.2875772	0.2461697	0.0022698	0.8959153

Source: Own estimation result, August 2020

Table 18: Comparison of Performance of different matching estimator for total annual income

Matching estimator	Performance criteria		
	Balancing test*	pseoudo-R2	matched sample size
NN			
NN (1)	11	0.270	189
NN (2)	11	0.288	180
NN (3)	12	0.288	180
NN (4)	12	0.288	180
Radius caliper			
0.01	12	0.288	147
0.25	11	0.288	198
0.5	8	0.232	198
Kernel			
band width 0.1	12	0.288	190
band width 0.25	12	0.288	198
band width 0.5	10	0.270	198

Source: Own estimation result, August 2020 N.B: * Number of explanatory variables with no statistically significant mean differences between the matched groups of PSNP participant and PSNP Non-participant households.

Table 19: Results of the Balancing tests of Covariates Using Kernel band width 0.25 Estimator

Variable	Mean		% bias	t-test		V(T)/V(C)
	Treated	Control		t	P>(t)	
Pscore	.71293	.6602	22.1	1.71	0.089	1.41
AGEHHH	41.055	40.335	7.6	0.54	0.592	0.60*
SEXHHH	.76364	.75301	2.4	0.18	0.855	
EDUHHH	.65455	.73359	-16.4	-1.26	0.208	
FAMILYSIZE	6.0091	6.0496	-1.9	-0.13	0.898	0.83
DIPRATIO	2.4	2.68	-30.0	-2.06	0.040	0.99
TOTALLAND	.33109	.31918	5.1	0.43	0.665	1.12
TOTALTLU	1.7609	2.1689	-21.0	-1.63	0.105	0.97
IMPROVEDSEED	.27273	.24068	6.9	0.54	0.590	
HOUSING	.69091	.69595	-1.3	-0.08	0.936	
CHEMICALFERTLIZER	.70909	.8132	-23.2	-1.81	0.072	
ACCESSTOEXT	.96364	.928	13.5	0.86	0.390	0.63*
ACCESSTOCREDIT	.56364	.40428	25.5	1.77	0.078	2.61*
DISTOEXTSERVICE	3.0918	3.18	-5.4	-0.39	0.695	0.53*

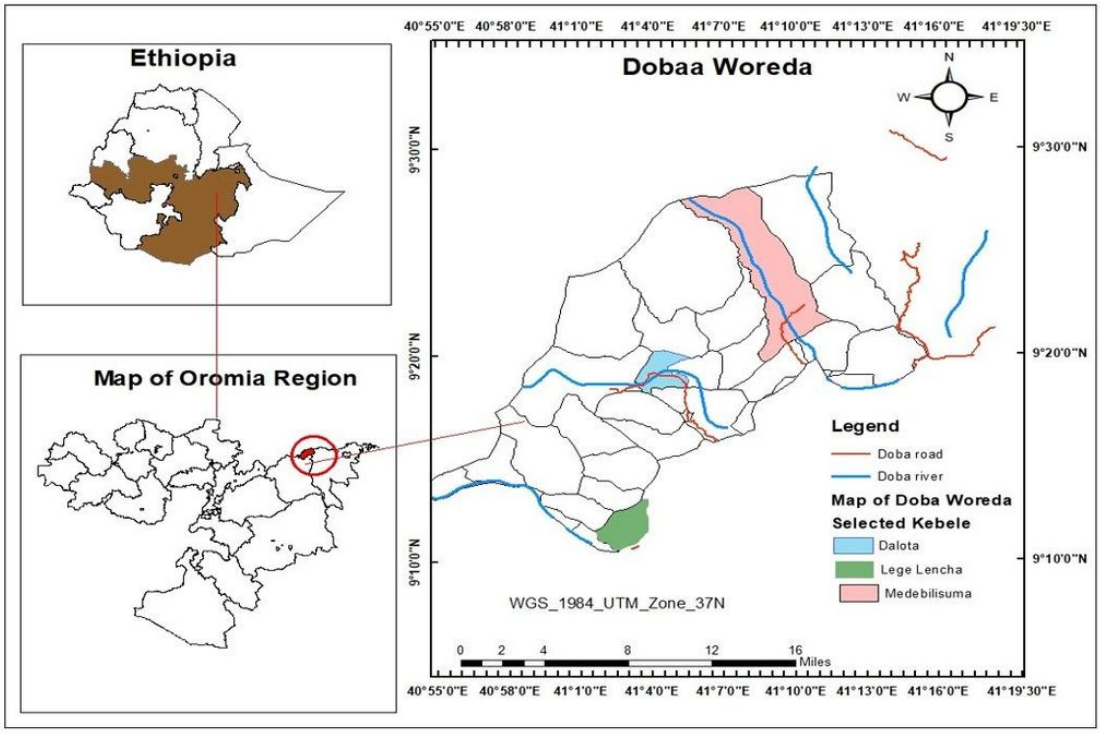
Source: Own estimation result, August 2020 N.B: ***, ** and * means significant at the 1%, 5% and 10% probability levels respectively.

Table 20: Average treatment effect on the treated (ATT) for annual income and dietary intake

Variable	Sample	Treated	Controls	Difference.	S. E	t-test
Total annual income	ATT	18581.05	13362.42	5218.63	1403.07	3.72 ***
Household calorie consumption	ATT	2390.027	2204.24	185.79	69.56	2.67 ***

Source: Own estimation result, August 2020 N.B: *** means significant at 1% probability level.

Figures



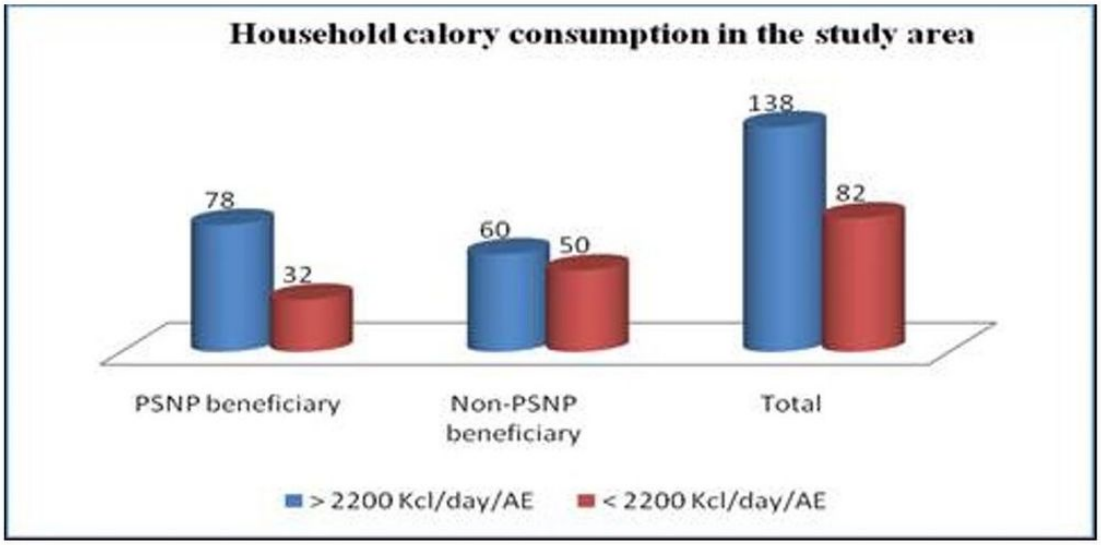


Figure 1

Map of the Study Area

Source: Ethio-GIS, 2020

Study area's food security status

Source: Survey result, August 2020

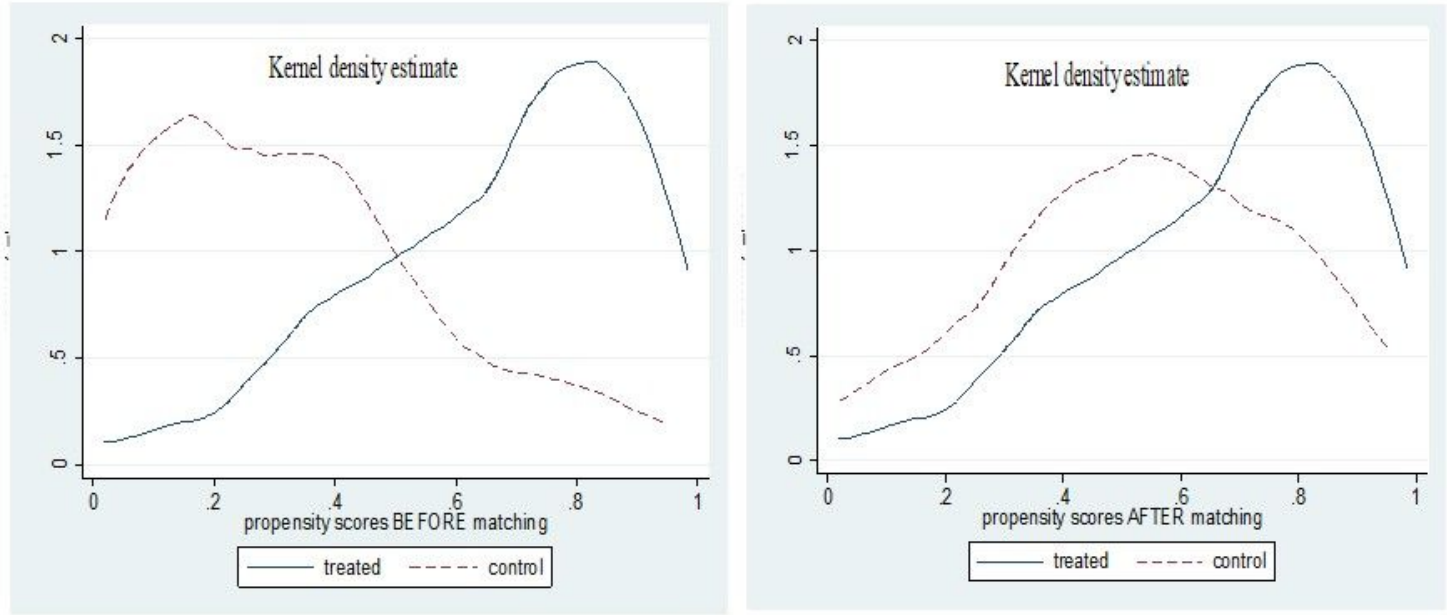


Figure 2

Kernel Density of PSM before matching (left) and after matching (right)