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**Full Length Research Paper**

**The Impact of Urban Productive Safety Net Program on the Households' Food Security: The Case of Debre Tabor City Administration**

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**Abstract**

The Ethiopian government has initiated the Urban Productive Safety Net Program to address poverty and chronic food insecurity affecting urban households. This study aimed to evaluate the UPSNP's impact on food security in Debre Tabor City. Three-stage sampling techniques were used to determine the sample size for the study. In the first stage, the researcher purposely selected all three sub-cities. Next, households within these sub-cities were divided into two strata. Finally, primary data were collected from a total of 338 sample households out of the total 2,171 households eligible for the urban productive safety net program using simple random sampling. The analysis utilized both descriptive statistics and econometric tools. Propensity Score Matching (PSM) methods have been applied to carry out impact evaluation. In addition, the PSM result was shown in relation to the participation model by Estimated Propensity Score, where among 11 explanatory variables in logistic modeling, 9 are significant. Key findings reveal that marital status, credit access, training opportunities, employment status, income, and home ownership negatively influence participation in the UPSNP. In contrast, age, family size, and dependents positively affect participation. The results indicated that participation in the UPSNP program significantly increased food consumption scores, Average treatment effect on the treated (ATE) (4.62 weights) at the 5% significance level, suggesting that it improved household food security compared to non-beneficiaries. Improving the UPSNP requires specific support for vulnerable households, better access to credit, and more training opportunities. By applying these strategies, the UPSNP can greatly enhance food security and economic conditions for its beneficiaries. The urban productive safety net is a new policy intervention in Debre Tabor City administration, as it started implementation in 2022. This study is unique because it explores the impact of this intervention, focusing on the Debre Tabor City administration as one of the cities involved.

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Attribution-

**1. Introduction**

Various studies have been conducted for empirical investigation to assess the impact of the PSNP on different facets of the economy. Gebresilassie's study (2020) investigates the role of the PSNP in influencing poverty in the central part of Tigray, Ethiopia. The findings suggest that an

impressive positive impact has been seen in reducing poverty via an increase in household expenditures, owning livestock, and accumulation. Furthermore, studies conducted by Mohamed (2017), Bugh et al. (2018), Bahru et al. (2020) assess the impact of the productive safety net program via its impact on the livelihood and food security of households, highlighting a remarkable

impact in this regard.

A recent study conducted by Tadesse and Gebremedhin Zeleke (2022) investigated the effects of safety net programs on expenditures, consumption expenditures, daily caloric in-take, and annual income. + Conversely, another research paper published by Abiye et al. in 2019 examined the impact of the program on assets accumulation and food consumption; this showed that the productive safety net program did not significantly contribute to asset accumulation and food consumption. In addition, Andersson et al. in 2011 showed that PSNP did not have a positive impact on improving assets holding for its target beneficiaries during times of stress. Thus, in conclusion, based on relevant literature examined in this section, the majority of literature portrays mixed findings concerning the impact created in relation to PSNP. While a few studies showed its positive impact, others showed negligible impact on households.

Additionally, several investigations have looked into the effects of the PSNP program, including research conducted by Yibrah (2019), Gebresilassie (2020), Tadesse and Gebremedhin Zeleke (2022), Mohamed (2017), Brugh et al. (2018), Bahru et al. (2020), Gebresilassie and Nyatanga, Abdulahi (2024), and Gebresilassie et al. (2025). These studies particularly examine how the UP-SNP influences household food insecurity or security by analyzing consumption expenditures and calories consumed as outcome measures. However, these studies did not consider the impact of rising prices nor the quality of consumption. This exclusion is noteworthy as increased food prices can affect purchasing power (Aluko, 2021; FAO, 2024; Von Braun & Tadesse, 2012). According Ha, Kose, Ohnsorge, (2021), the average food price inflation in Ethiopia was about 24.5% from 2018 to 2022 (five years) and Mengistu, Legassu and Alemu (2025) investigated the effect of food price inflation on household food security using household survey panel dataset and concluded that food price inflation is a significant driver of household food insecurity in Ethiopia.

Measures of food consumption based on caloric content focus primarily on the supply of food,

reflecting upon energy accessibility, but fail to entirely account for nutrition itself, defined as vital nutrients like proteins, vitamins, and minerals essential to well-being (FAO, 2023; Kakwani & Son, 2016).

The Food Consumption Score is a composite measure that assesses household food security by integrating dietary diversity and the frequency of food consumption with the nutritional quality of different food groups. It has been proven to be a good proxy for access to food by households, as it is validated against levels of caloric intake. The Food Consumption Score takes into consideration both quantity and variety of food consumed, emphasizing the importance of various food groups and their nutritional quality in terms of general dietary health and sufficiency.

The authors used the Food Consumption Score, which is considered an important tool for measuring food security. Using this methodology can help provide a better understanding of the challenges that households face concerning their lack of food security. This study explores the impact that is achieved by the Urban Productive Safety Net Program in terms of food security to address the existing methodological gap.

The Urban Productive Safety Net Program (UP-SNP) is a newly introduced program in Debre Tabor city as it started implementation in 2022. It aimed at helping economically disadvantaged people in urban areas, but there have been few findings on its benefits, especially on its links to food security issues. It is crucial to evaluate its impacts on food security in order to understand its effectiveness and wider possibilities for its applications. This study was conducted to assess the impacts of the UPSNP program on food security in the district level of Debre Tabor, which is located in the South Gondar in the Amhara Region in Ethiopia.

The main aim of the study is to assess the impact of the urban productive safety net program on the food security status among the household members in the Debre Tabor City administration.

The rest of the paper is outlined as follows: section 2 will cover the literature review. Section 3 will concentrate on the methodology applied in the research, wherein the techniques applied in

collecting the data, sampling, and analyzing the collected information will be discussed. Section 4 will highlight the outcomes and discuss the findings of the research, and lastly, section 5 will provide the conclusions and recommendations anchored on the findings of the study.

## 2. Literature

A study conducted by Amede (2020) assessed the influence of a productive safety net program on household food security in the Kutaber district located in the Amhara national regional state, Ethiopia. The analysis utilized a propensity score matching (PSM) technique. Findings indicate that, on average, participants in the program increased their calorie consumption by 233.04 Kcal compared to non-participants, with statistically significant differences in calorie intake. In a similar vein, Gebresilassie (2020) investigated the effects of a productive safety net program on poverty alleviation among households in Tigray, Ethiopia, employing the PSM and Foster-Greer-Thorbecke (FGT) methods. The poverty rate for program beneficiaries was lower (27 percent) compared to non-beneficiaries (30 percent). The incidence of poverty among female-headed households was higher (32 percent) compared to their male counterparts (25 percent). The overall consumption expenditure per adult equivalent for non-participants was lower than that of program participants. Additionally, the productive safety net program significantly contributed to diminishing household poverty and successfully reached the most disadvantaged households. To lower the overall poverty levels in both the region and the nation, it is essential to focus on decreasing gender disparity in poverty while maintaining consistent efforts in government-administered productive safety net program districts (woredas) to enhance the pace of poverty alleviation.

In Kenya, research conducted by Song and Imai (2019) evaluated the effects of "Kenya's Hunger Safety Net Program (HSNP)" using the double-difference estimation method. The analysis showed that beneficiaries of the HSNP notably decreased their multidimensional poverty levels. This reduction was primarily attributed to

declines in both the poverty headcount and the intensity level among the most impoverished individuals. The research also pointed out that an emphasis on short-term impact evaluations, insufficient funding, and poor program execution might underappreciate the potential of the program in alleviating poverty.

Similarly, Hidrobo et al. (2018) conducted a meta-analysis on the effects of social protection relating to food security and asset development. The findings indicated that participants in social protection programs enhanced their calorie intake from animal-sourced foods and increased their food consumption expenditure values by 8 and 13 percent, respectively. Additionally, the results suggested that social protection initiatives led to an increase in household asset ownership, including both agricultural and non-agricultural productive assets, livestock, and savings.

The recent study by Amosha & Abi (2023), on assessing the impact of the Urban Productive Safety Net Program (UP-SNP), focused on urban food security status among households located within the Gulele sub-city of Addis Ababa, Ethiopia. Within the study, the authors aimed to understand the influence that UP-SNP has on enhancing urban food security status. The study employed a study sample of 271 households, with results indicating that "49 percent of households were classified as being in a state of moderate food insecurity," 26 percent being mildly food insecure, and a further 23 percent being substantially "severely food insecure." Only "2 percent of households were identified to be food secure." Performative factors on food security status among households included "savings, household size, expenditure on durable goods, and age." UP-SNP had a positive effect on the status of food security among households that participated, however, failed to enhance their livelihoods.

On the other hand, Gebresilassie and Nyatanga (2023) undertook research on the impacts of the UPSNP on food security in urban households in Tigray, Ethiopia. Their research, which was done in March 2020, identified 398 households composed of both 168 non-beneficiaries and 230 UP-SNP beneficiaries and found that 22% of food-

insecure beneficiaries were attributed to UPSNP, compared to 36% of food-insecure non-beneficiaries. It was established through PSM that there was a positive correlation between UPSNP and both the income and consumption expenditures of beneficiaries.

Abdulahi et al. (2024) examined the impact of urban Productive Safety Net Pro-gram (UPSNP) interventions on food security and levels of poverty within the cities of Jigjiga, Harari, and Dire-Dawa in the East Ethiopian region. The study utilized data collected from 507 households in 2022, including non-beneficiaries and beneficiaries of the UPSNP, totaling 272 and 235, respectively. By utilizing the household food security index, foster greer thorbecke index, endogenous switching regression, and propensity score matching, the study concluded that variables such as households that owned assets, had savings, and possessed children and age determined their participation in the program.

Moreover, ESR and PSM analysis showed that the UPSNP improved household food security and reduced poverty levels as the number of calories consumed was high for the beneficiaries compared to non-beneficiaries. Furthermore, Demsash et al. (2023) examined the geo-graphic distribution of households receiving food or cash transfers from the P-SNP in Ethiopia, which included the Productive Safety Net Program for Food Security and Poverty Reduction strategy. The research study included a sample size of 8,595 households based on Ethiopian Demographic and Health Survey data (EPHI, 2019), and 14% of the households receiving PSNP were found to benefit from the program.

Significantly, the distribution of PSNP beneficiary households who received either food or cash transfer was not random. Households based in Amhara, Addis Ababa, Oromia, and SNNP had better access to these reliefs. According to a study done using a “multilevel mixed-effect logistic regression analysis,” it was established that factors such as age operating within a 25-44 years bracket, participation in community-based health insurance schemes, female-headed households, and living in a rural setting were significant

factors that influenced the probability of a household receiving food and cash from PSNP.

The research paper presented by Gebresilassie et al. (2025) seeks to establish the impact of the urban productive safety net program (UPSNP) in relation to food insecurity and school attendance of children in urban households in Tigray, Ethiopia. Researchers collected the required information from urban households that totaled 333 between August and September 2020. They used the FGT index to evaluate food insecurity intensity and the propensity score matching technique to establish the effect of the urban productive safety net program. From the research findings, it was evident that about 56.7% of food-secure urban productive safety net program households were food-secure, with an average of 2469.964 kcal per adult equivalent food intake. In a remarkable finding, female-headed urban productive safety net program beneficiary households were food-secure at a rate higher than that of male-headed urban productive safety net program beneficiary households. In particular, food security stood at 50.8%, whereas only 5.9% were observed in male-headed non-beneficiary households. Additionally, children from UPSNP beneficiary households had a higher frequency of school attendance compared to those from non-beneficiary households. These findings underscore the urgent need to expand the UPSNP to effectively combat household food insecurity and improve educational outcomes for children in urban settings.

### **Critical Summary of literature**

This literature review is composed of several productive safety net programs in Ethiopia and other countries such as Kenya, mainly using propensity score matching (PSM), Foster-Greer-Thorbecke (FGT) index, and other quasi-experimental designs. Interventions in rural areas, like Ethiopia’s Productive Safety Net Program (PSNP) in different regions of Ethiopia, show positive impacts, including an average gain of 233 kcal per person per day, reduced poverty (for example, 27% in PSNP and 30% in non-participants), and increases in consumption expenditure, especially for vulnerable groups like female-headed households (Gebresilassie, 2020), which is supported

by other results from the Kutaber study). The Hunger Safety Net Program (HSNP) in Kenya improves multidimensional poverty, as shown by decreases in headcount and intensity (Song & Imai, 2019). Moreover, a meta-analysis supports positive impacts from social protection interventions, which include increases in calorie intake (8-13% from animal source calories), asset ownership, and savings (Hidrobo et al., 2018). Geospatial analyses show non-random allocation of resources from PSNP, which tends to favor some regions like Amhara and Oromia, and which are influenced by age (25-44 years), residence (rural), and female-headed households (Demsash et al., 2023).

Studies on Urban Productive Safety Net Program (UPSNP) in Ethiopian cities (Addis Ababa, Tigray, Jigjiga, Harari, Dire-Dawa) show mixed results, although positive trends have been observed. These results include, but not limited to, increased calorie intake (2469 kcal/adult equivalent), reduced food insecurity (22% vs. 36% non-beneficiaries), reduced poverty, and improved school attendance of children, especially in female-headed households (Gebresilassie et al., 2025; Gebresilassie & Nyatanga, 2023; Abdulahi et al., 2024). Still, urban food insecurity remains

high, e.g., 49% moderate and 23% severe in Guele sub-city, with only 2% of food-secure households, and programs have not fully improved urban livelihoods, e.g., due to household size, savings, and assets (Amosha & Abi, 2023). Most seriously, although programs have shown success in addressing vulnerabilities and short-term results, lack of funding, execution, and gender differences, along with urban scaling, highlight the need for further coverage, equity, and long-term evaluations to ensure maximum impact on poverty alleviation.

The conceptual framework as visual presentation of relationship between the variables is depicted in **Error! Reference source not found..**

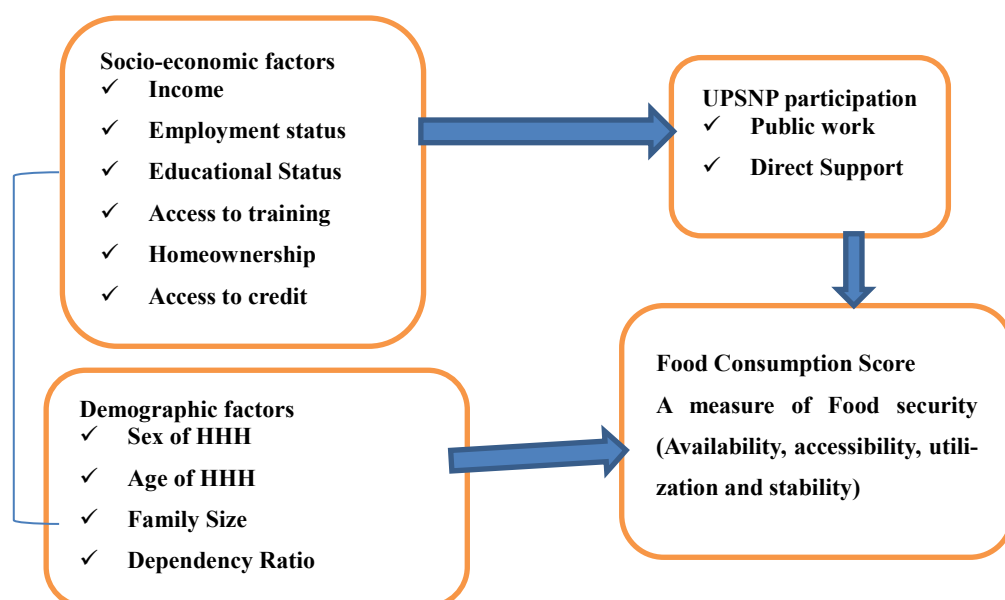


Figure 1: Conceptual model for food in/security of beneficiaries (Source: Formulated from Several literatures reviewed)

### 3. Methodology of the study

This research utilized a quasi-experimental design to evaluate the effects of the Urban Productive Safety Net Program (UPSNP) on food security among households, employing Propensity Score Matching (PSM) to identify differences between treated and untreated households, which helps clarify the elements that affect intervention results.

The data for this research was sourced from primary means. Specifically, the data is cross-sectional, incorporating both quantitative and qualitative information primarily gathered from heads of participant and non-participant households. The Debre Tabor city administration was selected for this analysis due to its significance in food security related to the urban productive safety net program. Within the Debre Tabor city administration, there are 1,100 heads of beneficiary households and 1,071 heads of non-beneficiary households, amounting to a total of 2,171 households targeted for the UPSNP (Debre Tabor city UPSNP, 2024).

A two-stage sampling technique was employed to determine the sample size relevant to the study. In the first phase, the researchers purposefully selected all three sub-cities. In the second phase, households from these sub-cities were divided into two groups: the first group comprises UPSNP participants, while the second group consists of non-UPSNP participants. Lastly, a simple random sampling technique was employed to select a total of 338 household heads. The sample size was determined using Yamane's (1973) formula, applying a 95% confidence level and a precision level of 5%.

$$n = \frac{N}{1 + Ne^2}$$
 This calculates the necessary sample size at a 95% confidence level with a margin of error set at 0.05, where  $n$  refers to the number of samples to be chosen,  $e$  denotes the permissible sampling error, and  $N$  indicates the size of the population, reflecting a 95% confidence level along with an  $e$  value of 0.05 for margin of error. According to Debre Tabor city urban productive safety net program office (2025), there were 2171 eligible for safety net program intervention in the

city. Out of these eligible households 1100 were selected for the intervention (participants) and the remaining 1071 were not selected (non-participants)

$$n = \frac{N}{1 + Ne^2} = \frac{2171}{1 + 2171(0.05)^2} = 338$$
 (approximate value)

From both participants and non-participants sample size of each kebele was determined based on proportional allocation as follows:

$$n_i = \frac{nN_i}{N}$$
, where  $n_i$  is the number of sample size in  $i$ th sub-city,  $n$  is sample size,  $N_i$  is total number of households in  $i$ th sub-cities, and  $N$  is total number of households.

For strata with  $N_1$ ,  $n_1 = 338 \left( \frac{1100}{2171} \right) = 171$  (UPSNP participant) and

For strata with  $N_2$ ,  $n_2 = 338 \left( \frac{1071}{2171} \right) = 167$  (non-UPSNP participant)

In assessing the Urban Productive Safety Net Program (UPSNP), beneficiaries are chosen through a random selection process, which can lead to selection bias. Propensity score matching (PSM) technique is employed in order to determine the effect of the program on household food security. PSM generates a control group of non-beneficiaries that closely matches the treatment group (participants of the UPSNP) based on observable factors that influence their participation. This involves pairing participants with non-participants who share similar propensity scores. To gauge the impact of UPSNP on food security, a comparison is made between the actual outcomes of participants and the projected outcomes had they not taken part in the program. The analysis model is defined as follows. The Logit model is frequently employed for binary outcome variables. The binary logistic regression model for household food security can be represented as:

$$\text{Logit}(P) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + \beta_{10} X_{10i} + \beta_{11} X_{11i} + \epsilon_i$$

$X_1$  = sex of household head (sexhh); 1 if male, 0 if female.

$X_2$  = age of household head (agehh), in years and continuous

X<sub>3</sub> = marital Status of household head (marshh); 1 if Married, 0 otherwise

X<sub>4</sub> = family size (mlshh), typically, children (ages 0-14), adult (ages 15-65), and older (ages above 65); in number and continuous

X<sub>5</sub>= educational level of household head (educ-thh); “1” if no formal education, “2” for Read and write, “3” for Completed Primary school, “4” for Completed High school “5” for TVET and above

X<sub>6</sub>= Dependency ratio (derhh) (in number and continuous)

X<sub>7</sub>=household head’s employment status (em-lshh); “1” if employed, “0” unemployed.

X<sub>8</sub>= homeownership of home (Inch) (1 if the respondent home owner; 0 if rental).

X<sub>9</sub> = Training (atrainhh); 1 if the household head is trained; 0 not trained

X<sub>10</sub> =access to credit (1: Have access 0: Do not have access)

X<sub>11</sub>= Households monthly income: in ETB

e=error term

$$D_i^* = \gamma_0 + \gamma_1 X_{1i} + \gamma_2 X_{2i} + \gamma_3 X_{3i} + \gamma_4 X_{4i} + \gamma_5 X_{5i} + \gamma_6 X_{6i} + \gamma_7 X_{7i} + \gamma_8 X_{8i} + \gamma_9 X_{9i} + \gamma_{10} X_{10i} + \gamma_{11} X_{11i} + v_i$$

Where:  $D_i^*$  is the latent variable for the household's participation in the UPSNP.

$\gamma_0$  is the intercept, and  $\gamma_1, \dots, \gamma_{12}$  are the coefficients.

$v_i$  is the error term, assumed to be normally distributed.

The observed participation is given by:  $D_i = \begin{cases} 1, & \text{if } D_i^* > 0 \\ 0, & \text{otherwise} \end{cases}$

The participation equation can be specified as follows:

$$P(Y_i=1|X_i) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki})}} = \frac{e^{(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki})}}{1 + e^{(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki})}}$$

Where  $P(Y_i=1|X_i)$  is the probability of participation ( $Y = 1$ ) given the independent variables  $X$ ,  $\beta_0$  is the intercept, and  $\beta_1, \beta_2, \dots, \beta_k$  are the coefficients for the independent variables  $X_1, X_2, \dots, X_k$ .

Outcome Equations: Based on participation status, the food security equation differs for participants and non-participants:

For Participants ( $D_i=1$ ):

$$Y_i = \alpha_0 + \alpha_1 X_{1i} + \alpha_2 X_{2i} + \alpha_3 X_{3i} + \alpha_4 X_{4i} + \alpha_5 X_{5i} + \alpha_6 X_{6i} + \alpha_7 X_{7i} + \alpha_8 X_{8i} + \alpha_9 X_{9i} + \alpha_{10} X_{10i} + \alpha_{11} X_{11i} + \epsilon_i$$

Where:  $\epsilon_{1i}$  are the error terms for participants and non-participants, respectively, which may be correlated with the selection equation error term  $v_i$

The three key equations establish the basis of the logit model by connecting probabilities, odds, and log odds.

**Table 1: Households food Consumption Score (FSC) categories**

| Threshold | Category      |
|-----------|---------------|
| (0–21)    | Food insecure |
| (21.5–35) | Borderline    |
| (>35)     | Acceptable    |

#### Source: Authors’ summary

The formula for ordering the food (in)security **Table 1**) is described as follows:

**FCS = (starches × 2) + (pulses × 3) + vegetables + fruit + (meat × 4) + (dairy × 4) + (fats × 0.5) + (sugar × 0.5)** (WFP, 2015). Once the food consumption score has been calculated, FCG thresholds can be established by analyzing the frequency of these scores alongside an

status of households (presented in understanding of consumption habits in the respective country or region (WFP, 2008). As per the World Food Program (2024a), the food consumption score, which usually varies between 0 and 112, is commonly utilized to evaluate the quality of an individual's diet.

## 4. Results and Discussion

### 4.1 Descriptive statistics of outcome

#### Outcome variables and Categories:

As shown in

**Table 2**, categories of Food Consumption Score, symbolized as fcscsym, include Acceptable, Borderline, and Poor. Beneficiaries refer to households who receive assistance or treatment, while non-beneficiaries refer to households who do not receive any assistance or treatment. The overall sample encompasses 338 households, with 171 classified as beneficiaries and 167 as non-beneficiaries.

When examining the FCS category breakdown, for the acceptable category, out of 58 total whose food security status is labeled as acceptable, 31 (i.e. 54.45%) are beneficiaries and the remaining 27 (i.e. 46.55% of them) are non-beneficiaries. This indicates that a higher proportion of this category belongs to the beneficiaries in line with our a priori expectation, the total households that have acceptable food security status account for only 17.16% from the total number of sample households (i.e. 58 out of 338). This is one of the manifestations of food security as a critical social and economic problem in Debre Tabor City. In the Borderline category, 94 beneficiaries (61.44%) out of 153 total number of borderline category households and the rest 59 (38.56%) are non-beneficiaries. Borderline households account for 45.27% of total sample households. This implies that a large proportion of sample households are vulnerable to food insecurity in case shocks arise. One should note that the urban productive safety net program started

implementation in this city in 2022 and hence, this impact evaluation is made on the ongoing intervention. That is, its full impact is yet to come. May be these households just moving from food insecurity status to the borderline and they may move up to acceptable level in years to come. Since these authors were unable to get access for base line data, they could not make comparison between current status and initial one for the beneficiaries and non-beneficiaries separately to assess within changes. In the Poor category, out of 127 food insecure households 46 (i.e. 36.22%) were beneficiaries and the non-beneficiaries account for 81 (i.e. 63.78%) total food insecure households. In addition, out of the total 338 sample households, 127 households (i.e. 37.57% of them) fall into food insecurity status. This reveals that a larger proportion of non-beneficiaries are categorized as having food insecurity based on the food consumption score measure. This indicates that urban food insecurity is, yet, a critical issue to deal with.

In conclusion, beneficiaries tend to show better food consumption scores, particularly within the Acceptable category, while non-beneficiaries display a higher proportion in the Poor category. This indicates that assistance programs may be successful in enhancing food security for beneficiaries. Furthermore, the overlap in the Borderline category suggests that both groups are significantly vulnerable. Overall, this analysis indicates that initiatives aimed at boosting food security are having a positive effect on beneficiaries compared to non-beneficiaries.

**Table 2: Summary Statistics of the outcome Covariates**

| Variables | Category | Beneficiaries<br>(171) | Non-beneficiaries<br>(167) | Total<br>(338) | Fcscsym |
|-----------|----------|------------------------|----------------------------|----------------|---------|
|           |          |                        |                            |                |         |

| Food Consumption Score(FCS) |               | N  | %     | N  | %     | N   | %     |   |
|-----------------------------|---------------|----|-------|----|-------|-----|-------|---|
|                             | Acceptable    | 31 | 54.45 | 27 | 46.55 | 58  | 17.16 | 1 |
|                             | Borderline    | 94 | 61.44 | 59 | 38.56 | 153 | 45.27 | 2 |
|                             | Food insecure | 46 | 36.22 | 81 | 63.78 | 127 | 37.57 | 3 |

#### Source: Authors' Estimation Result 2025

According to **Table 3**, the average Food Consumption Score (FCS) for non-beneficiaries is 25.85, with a standard deviation of 7.72, indicating a relatively consistent distribution of scores. Conversely, the beneficiaries, represented by 1, consist of 171 observations. This group shows a higher average FCS of 28.07, with the same standard deviation of 7.72, suggesting similar variability in scores as the beneficiary group. The mean comparison between the beneficiaries and non-beneficiaries indicates that the

average FCS for the Urban UPSNP beneficiaries (represented by 1) is significantly higher than that of the non-Urban group (represented by 0). This suggests that the UPSNP positively affects food consumption scores. Although both groups exhibit similar variability, the wider score range in the second group highlights the differences in outcomes.

In conclusion, the data suggest a potential association between the UPSNP variable and increased FCS.

**Table 3: Summary Statistics and Mean Difference Test of Outcome Variables**

| Variables            | Beneficiaries (171) |       | Non-beneficiaries (167) |       | Total (338) |       | MD     | T_value |
|----------------------|---------------------|-------|-------------------------|-------|-------------|-------|--------|---------|
| Food security status | Mean                | SD    | Mean                    | SD    | Mean        | SD    | -2.223 | -2.647* |
|                      | 28.073              | 7.722 | 25.850                  | 7.718 | 26.975      | 7.788 |        |         |

Source: Authors' Estimation Result 2025

## 4.2 Econometric analysis

### 4.2.1 Impact of urban productive safety net program on households' food security

Binary logistic regression was used to estimate propensity score matching for matching treatment households with control

households (Table 4). The dependent variable of this study is participation in the Urban Productive Safety Net Program (UPSNP), which is coded as 0 for non-participants and 1 for participants. With a likelihood ratio chi-square value of -115.62 and an overall model fit that was statistically significant at the 1% level, the logistic regression findings show that the model did well.

**Table 4: Logit model results of covariates of marginal effects**

| Participation in | Coef. | Stand.err | Z- | p> z | Marginal effect |
|------------------|-------|-----------|----|------|-----------------|
|------------------|-------|-----------|----|------|-----------------|

| UPSNP                       |         |         | value                |       | (dy/dx) |
|-----------------------------|---------|---------|----------------------|-------|---------|
| sexhh                       | 0.0082  | 0.0384  | 0.21                 | 0.831 | 0.0835  |
| agehh                       | 0.0096  | 0.0026  | 3.66                 | 0.000 | 0.0147  |
| mlshh                       | 0.0486  | 0.0175  | 2.78                 | 0.005 | 0.0828  |
| marshh                      | -0.3370 | 0.1471  | -2.29                | 0.022 | -0.0487 |
|                             |         |         |                      |       |         |
| educsth                     |         |         |                      |       |         |
| 2                           | 0.0200  | 0.1411  | 0.14                 | 0.887 | 0.2966  |
| 3                           | -0.0469 | 0.1454  | -0.32                | 0.747 | 0.2380  |
| 4                           | -0.2051 | 0.1563  | -1.31                | 0.189 | 0.1013  |
| 5                           | -0.3574 | 0.1798  | -1.99                | 0.047 | -0.0050 |
|                             |         |         |                      |       |         |
| derhh                       | 0.1615  | 0.0411  | 3.92                 | 0.000 | 0.2421  |
| epshh                       | -0.1113 | 0.0399  | -2.79                | 0.005 | -0.0331 |
| acshh                       | -0.0963 | 0.0360  | -2.68                | 0.007 | -0.0258 |
| homshh                      | -0.2302 | 0.0992  | -2.32                | 0.020 | -0.0357 |
| Inch                        | -0.0001 | 0.00002 | -6.46                | 0.000 | -0.0001 |
| atrainhh                    | -0.0959 | 0.0410  | -2.34                | 0.019 | -0.0156 |
| Number of obs = 338         |         |         | LR chi2(14) = 237.28 |       |         |
|                             |         |         | Prob > chi2 = 0.0000 |       |         |
| Log likelihood = -115.62048 |         |         | Pseudo R2= 0.5064    |       |         |

Source: Computed from own survey data of 2025

**Age of the household head (agehh):** The marginal effect of 0.0147 indicates that for every additional year of age in the household head, the probability of participating, on average, increases by approximately 1.5%. This positive correlation means that older heads of households are more likely to participate in the program, while young and active population may be willing to allocate more time to managing their livelihoods. This also supports the re-search by Azadi et al. (2017),

**Family Size (mlshh):** From the above table, it can be highlighted that the marginal effect value of family size is approximately 0.0835. This shows that family size has a positive relationship with the urban productive safety net program. Based on this value, it can be determined that for

every added adult equivalent family member, participation will be enhanced by 8.35% on average. The result is in line with a study by Gebresilassie et al., (2025). Likewise, a study that examined the impact of the urban productive safety net program in Dessie City, Ethiopia, established that households that had large family sizes were more likely to participate in the program (Dinku et al., 2023a).

**Marital status of the household's head (marshh):** Based on the marginal effect results in a coefficient of -0.049, representing a 4.9% decrease in results of participation dependent on marital status while considering other related factors constant.

Several factors or variables may be attributed to negative results of the Urban Productive Safety Net Program participation and marital status. In such a regard, one of these factors relates to how some unmarried individuals or heads of households, such as single mothers or fathers, may be targeted for more support.

In addition, married couples may have higher combined incomes, thus becoming less eligible for the UPSNP; they might also enjoy more social support networks, thereby reducing reliance on formal safety nets. This nuanced understanding paints a very different picture of social safety net programs, with various effects depending on demographic groups. A case in point is the finding from a single study that single household heads had a significantly higher odds ratio for food insecurity compared to married heads, pointing to marital status as one very important component of food security assessment (Tadesse, Tantu et al., 2017; Fikre & Tsige, 2025).

**Employment of household head (eplshh):** The marginal effect of the household head's employment status on participating in the urban productive safety net program is -0.033 with a p-value of 0.005. noted that a negative coefficient implies that, as the employment status of the household head improves, i.e., as The household head with formal employment, is less likely to participate in the program than the unemployed one by 3.3%. This means that families headed by employed individuals are at lower probabilities of dependency on the safety net program, thereby reinforcing its purpose of supporting the economically disadvantaged households.

**Education level of household head (educsthh):** With regard to categories 2-5, which involve education at a higher level, generally inconsistent findings are noted, whereas category 5 (TVET & above) is found to have a negative impact, statistically significant at  $p=0.048$ , concerning the Urban Productive Safety Net Program participation; lower level education shows insignificant effect on participation. That is other considerations matter in participant selection than lower level of education.

**Income of the household of the head (inch):**

The marginal effect for the income variable of the household head was -0.000083 with a p-value of 0.0000. The negative value of the coefficient implies that as the income level of the household head rises, the probability of participation will fall, but only slightly on a percentage basis. It means that for every unit increase in income level, the probability will drop by 0.0083%. Indeed, as income level rises, participation in the safety net program tends to fall, underscoring its ultimate goal of providing targeted assistance for those who are economically disadvantaged.

**Access to credit (acshh):** The analysis shows that the marginal effect of access to credit for household heads in relation to participation in the urban productive safety net program is -0.026, meaning that higher access to credit decreases the likelihood of program participation. Household with access to credit are less likely to participate into the program than those with no access to credit by about 2.6%. Finally, as access to credit improves; the need to participate in the safety net diminishes. These findings are supported by previous empirical studies such as that by Kehinde & Kehinde (2020), Zimani et al. (2025), Boltana et al. (2023), among others.

**Homeownership of household head (homshh):** the marginal effect of house ownership by the household head on participation in the urban productive safety net program is -0.036. The negative sign of this coefficient shows that house ownership negatively affects the likelihood of the family's participating in the program, which indicates that households headed by owners are about 3.6% less likely to take part. This may imply that the need for homeowners to participate in the program is limited.

**Access to training (atrainhh):** The results show a marginal effect of -0.016 on the access to training for households, with a corresponding p-value of 0.019. This, in essence, points to values where those households with access to training are less probability to participate in the program by 1.6% than households do with no access to training.

**Table 5: Summary of stata results of Average Treatment Effect on Treated for FCS after matching**

| Variable Sample                                                                      | Treated                     | Con-<br>trol | Difference | S.E.   | T-stat |
|--------------------------------------------------------------------------------------|-----------------------------|--------------|------------|--------|--------|
| <b>fcs unmatched</b>                                                                 | 28.0740                     | 25.0583      | 3.0157     | 0.8398 | 2.65*  |
| <b>ATT</b>                                                                           | 28.0876                     | 23.1828      | 4.9048     | 1.4079 | 3.49*  |
| <b>ATU</b>                                                                           | 24.9247                     | 29.1438      | 4.2191     |        |        |
| <b>ATE</b>                                                                           |                             |              | 4.62       |        |        |
| <b>Note: S.E. does not take in to account that the propensity score is estimated</b> |                             |              |            |        |        |
| <b>psmatch2:<br/>treatment Assignment</b>                                            | psmatch2:<br>Common support |              | Total      |        |        |
|                                                                                      | Off sup-<br>port            | On support   |            |        |        |
| <b>Untreated</b>                                                                     | 69                          | 98           | 167        |        |        |
| <b>Treated</b>                                                                       | 34                          | 137          | 171        |        |        |
| <b>Total</b>                                                                         | 103                         | 235          | 338        |        |        |

**Source: Authors' computation using Stata 2025**

This statistic reflects how well the regressors (x) explain the probability of participation (Caliendo & Kopeinig, 2008). After matching, there should be no systematic differences in covariate distributions between the groups, resulting in a low pseudo-R<sup>2</sup>. Likelihood ratio test: An insignificant

likelihood ratio indicates that the groups are comparable.

Chi-square test: This test evaluates the joint significance of all regressors, and it should also be insignificant after matching, as indicated by the p-value.

**Table 6: Average Treatment Effect on Treated for FCS before matching**

| Variable Sample                                                                      | Treated                     | Con-<br>trol | Differ-<br>ence | S.E.   | T-stat |
|--------------------------------------------------------------------------------------|-----------------------------|--------------|-----------------|--------|--------|
| <b>fcs unmatched</b>                                                                 | 28.073                      | 25.850       | 2.223           | 0.8399 | 2.65*  |
| <b>ATT</b>                                                                           | 28.055                      | 23.305       | 4.75            | 1.9759 | 3.40*  |
| <b>Note: S.E. does not take in to account that the propensity score is estimated</b> |                             |              |                 |        |        |
| <b>psmatch2:<br/>treatment Assign-<br/>ment</b>                                      | psmatch2:<br>Common support |              | Total           |        |        |
|                                                                                      | Off support                 | On support   |                 |        |        |
| <b>Untreated</b>                                                                     | 0                           | 167          | 167             |        |        |

|                |    |     |     |
|----------------|----|-----|-----|
| <b>Treated</b> | 35 | 136 | 171 |
| <b>Total</b>   | 35 | 303 | 338 |

### Source: Authors' computation using Stata 025

**Table 6** summarizes the results of a propensity score matching analysis, examining the distribution of key demographic and socioeconomic variables between treated and control groups. It encompasses various factors, including sex, age, education, and income, enabling a comprehensive comparison. The columns detail whether the statistics pertain to unmatched or matched samples, present the mean values for both groups, indicate the percentage reduction in bias achieved through matching, and provide t-statistics and p-values to assess the significance of the differences observed. Additionally, variance ratios are included to evaluate the balance between the treated and control groups.

Columns Explained (Unmatched/Matched) =Indicates whether the statistics are for unmatched or matched samples, Mean=Average value for treated and control groups, % Reduction=Percentage reduction in bias after matching, Bias=The absolute difference in means between treated and control groups, t-test=T-statistic for testing the significance of the difference in means, p-value ( $p > t$ ) =Probability value associated with the t-test, indicating significance. ,  $V(T)/V(C)$  =Variance ratios for treated and control groups to assess balance.

The analysis (**Table 6**) presents several variables assessed for joint significance, comparing treated and control groups both before and after matching. For Sex, the unmatched means show a slight positive bias of 11.6%, which becomes negligible at -2.4% after matching, indicating comparability in terms of sex. Age shows a significant unmatched bias of 96.6%, reducing to 13.3% post-matching, demonstrating improved balance, with significant t-test results ( $t = 8.86$ ,  $p < 0.001$ ) in both conditions. Family size has an unmatched bias of 96.3%, also significant ( $t = 8.83$ ,  $p < 0.001$ ), which decreases to 22.3% in the matched dataset, suggesting better balance. Marital status displays a minor unmatched bias of -20.6%, which is not statistically significant and remains

similar after matching. The variable 2.Educsthh initially has a large bias of 48.7%, which becomes insignificant at -9.0% after matching, showing no significant differences. 3. Educsthh shows minimal bias in both unmatched (-6.8%) and matched (5.1%) states, indicating comparability. For 4.Educsthh, there is a significant unmatched bias of -33.3%, which decreases to -7.8% after matching but remains negative. 5. Educsthh shows an extreme unmatched bias of -60.8%, reduced to a small positive bias of 4.6% post-matching. The variable dependency ratio has a high unmatched bias of 90.1%, which decreases to 14.6% after matching, indicating improved comparability. Employment status reveals an unmatched bias of -60.2%, indicating significant disparity ( $t = -5.54$ ,  $p < 0.001$ ), minimized to 2.9% after matching. The variable access to credit shows a significant unmatched bias of -52.4%, reduced to -6.3% post-matching. For home situation, the unmatched bias is -28.3%, significant ( $p = 0.010$ ), while after matching, it becomes negligible at 0.4%. Income indicates severe unmatched bias of -82.1%, slightly reduced to -9.0% post-matching, and participation in training shows a moderate unmatched bias of -34.4%, decreasing to -4.0% after matching. The joint significance of these variables is evaluated through their p-values and the reduction in bias achieved through matching; significant p-values (typically  $< 0.05$ ) indicate influence on results. The reduction in bias suggests that these variables are balanced across treated and control groups, leading to more reliable comparisons. In summary, the analysis demonstrates that matching effectively reduces biases across variables, enhancing the comparability of treated and control groups, with variables like age, family size, and employment status initially showing significant disparities that were largely mitigated through matching, indicating a successful adjustment process.

[Summary of propensity score matching analysis](#)

The initial analysis revealed that most unmatched variables exhibited significant bias, indicating substantial differences between the treated and control groups. However, post-matching improvements showed a considerable reduction in biases, with several variables achieving near balance; critical factors such as age and family size demonstrated notable enhancements. While the unmatched data indicated significant differences with p-values less than 0.05, many variables lost their statistical significance after matching, suggesting variability in the effectiveness of the matching process. Variance ratios also pointed to

group comparability, yet values outside acceptable limits raised concerns about potential variance equality issues that could undermine the validity of comparisons. Ultimately, the matching process facilitates valid comparisons of beneficiary outcomes against a matched group with similar characteristics, thereby enhancing the reliability of causal inferences related to treatment effects. This analysis underscores the importance of employing robust matching procedures in observational studies to ensure comparability and obtain reliable results.

**Table 7: Overall Balance Indicators of Covariates**

| Sample                        | Ps R2 | LR Chi2 | p>chi2 | MeanBias | Me-Bias | B     | R    | %var |
|-------------------------------|-------|---------|--------|----------|---------|-------|------|------|
| Un-matched                    | 0.507 | 237.70  | 0.000  | 51.6     | 50.6    | 198*  | 0.75 | 100  |
| Matched                       | 0.037 | 14.20   | 0.435  | 8.8      | 7.1     | 44.5* | 1.89 | 25   |
| *if B>25%. R outside [0.5; 2] |       |         |        |          |         |       |      |      |

Source: Authors' Estimation Result 2025  
Based on

**Table 7**, the Stata results, here's a brief interpretation of the Propensity Score Matching (PSM) diagnostics and the acceptability of the matching method:

**Unmatched Results:** The initial model has a PS R<sup>2</sup> of 0.507, explaining 50.7% of the variation in propensity scores and demonstrating strong predictability in the matching process. The likelihood ratio test yields a chi<sup>2</sup> value of 237.70 with a p-value of 0.0000, indicating a highly significant relationship between the covariates and treatment assignment in the unmatched model. Additionally, the mean bias is 51.6 and the median bias is 50.6, reflecting significant imbalance between the treated and control groups prior to matching. With a bias value of 189.3, a balance ratio of 75%, and a variance of 100, these findings underscore that the covariates are not fully balanced in the unmatched sample.

**Matched Results:** Post-matching, the model has a PS R<sup>2</sup> of 0.037, indicating it explains only 3.7%

of the variation in propensity scores, which is expected due to better balance among covariates. The likelihood ratio test shows a chi<sup>2</sup> of 4.2 with a p-value of 0.435, indicating no significant difference and successful balance between treated and control groups on observed covariates. Additionally, the mean bias is 8.8 and the median bias is 7.1, both of which have significantly decreased and are now within acceptable limits. Overall, the figures of B = 44.5, R = 1.89, and % Var = 25 reflect improved balance after matching.

**Test Results:** In the unmatched sample, 9 out of 11 variables are statistically insignificant, indicating substantial differences between the groups. However, in the matched sample, all 11 variables are statistically insignificant, confirming successful matching and balance. Overall, the matching method effectively reduced bias and improved covariate balance, as evidenced by t-tests and decreased bias. The diagnostics show that the matched sample is well balanced,

achieving the objective of minimizing imbalance. Consequently, the matching method is appropriate, and the results can be considered reliable for causal inference.

### **Estimation of Average Treatment Effect on the Treated (ATT)**

Average Treatment Effect on the Treated (ATT): The ATT of 4.91 measures the effect of the treatment specifically for those who received it. This positive value indicates a substantial treatment effect, meaning that participants who received the treatment show an improvement in outcomes by about 4.91 units compared to what their outcomes would have been without the treatment. The significance of this result suggests that the treatment is effective for the treated group.

The Average Treatment Effect on the Treated (ATT) and the Average Treatment Effect (ATE) are key concepts in evaluating the impact of a treatment or intervention. The ATT, which is 4.91, measures the average effect of the treatment specifically among those who received it, indicating a positive impact for this group. In contrast, the ATE, at 4.62, reflects the average effect across the entire population, including both treated and untreated individuals.

Findings from Studies: Research indicates that participation in the UPSNP has a positive and significant impact on food security among beneficiary households. For instance, households involved in the program reported higher levels of food consumption and improved food security status compared to non-beneficiaries (Dinku et al., 2023b).

The higher ATT suggests that the treatment was particularly effective for those who participated, while the lower ATE may imply that individuals who did not receive the treatment have different characteristics that affect its effectiveness. This distinction is crucial for policymakers and practitioners, as it highlights the importance of targeting specific populations to maximize the treatment's impact. Overall, the differences between ATT and ATE provide valuable insights into how treatments can be tailored for better outcomes.

## **5 Conclusions and Recommendations**

This study investigates the impact of the Urban Productive Safety Net Program (UPSNP) on household food security using a quasi-experimental design, specifically employing Propensity Score Matching (PSM) to address selection bias. By comparing beneficiaries and non-beneficiaries of the program, the research aims to construct a plausible counterfactual to better understand the effects of the intervention.

Data collection involved a cross-sectional survey focusing on socioeconomic characteristics and food consumption scores, with a sample size of 338 households derived from a total of 2,171 targeted households in the Debre Tabor city administration. The analysis utilized both descriptive and inferential statistical methods, including t-tests and chi-square tests, to assess differences between groups.

The analysis involved estimating propensity scores through binary logistic regression, ensuring valid comparisons by defining a common support region. The result showed significant differences between beneficiaries and non-beneficiaries, with a likelihood ratio chi-square of -115.62 and a pseudo- $R^2$  of 50.64%. After excluding 103 observations outside the common support, the findings confirm that the UPSNP significantly enhances food security among urban households.

The analysis of food consumption scores (FCS) reveals notable differences between non-UPSNP and UPSNP beneficiaries of the Productive Safety Net Program (UPSNP). The Urban group, averaging an FCS of 28.07, demonstrates better dietary diversity compared to the non-Urban group's average of 25.85. Both groups show similar variability, but the urban group has a wider range of outcomes. Overall, beneficiaries generally exhibit better food security, with a higher percentage classified as having acceptable scores, though risks remain, particularly in the Borderline category.

The UPSNP appears effective in improving food security, suggesting its potential for application in similar contexts. Further statistical analysis is recommended to validate these associations and

refine intervention strategies.

The study successfully matched 137 participant households with 98 non-participant households to compare food consumption scores, ensuring that differences were solely due to program participation. The analysis found that the Urban Productive Safety Net Program (UPSNP) significantly enhanced food consumption scores by 4.62 weights, indicating improved food security for participants at a statistically significant level (5%).

In conclusion, the study highlights the vital role of the UPSNP in improving food security among poor households. The effective matching process validates the comparisons made, supporting the continuation of the program to enhance food security outcomes, not only for participants but potentially for the wider community as well.

Based on the analysis of the survey findings the researcher provided, here are recommendations to enhance the effectiveness of the Urban Productive Safety Net Program (UPSNP) and address the issues identified:

First, the authors suggest refining targeting mechanisms in programs like the UPSNP by focusing on demographic factors such as age, family size, and marital status, especially prioritizing vulnerable households like single-parent and larger families. It recommends adjusting benefits based on family size to enhance support, particularly for single-parent households, through child-care services and flexible work options. Additionally, it calls for interventions for households with high dependency ratios, such as nutritional assistance and educational support. Implementing these strategies aims to better address socio-economic challenges and improve food security and economic stability for beneficiaries.

Second, improving access to credit for UPSNP beneficiaries is crucial, and this can be achieved through collaborations with financial institutions to develop tailored loan products for low-income households. Additionally, increasing training opportunities is vital; implementing targeted skills development programs focused on income-generating activities, nutrition, and food security management can empower beneficiaries to become more self-sufficient.

Lastly by implementing these recommendations, the UPSNP's effectiveness can be significantly improved, food security among beneficiaries can be enhanced, and the socio-economic uplift of vulnerable urban households can be achieved. Ongoing evaluation and adaptation will be crucial to meet the changing needs of the community.

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