The Effect of *Ye Enat Weg School* Feeding Program on Student Academic Performance: The Case of Primary Schools in Yeka Sub-city Addis Ababa

Tedla Hailemariam[1] and Abrham Seyoum[2]

Received: 2 August 2019; Accepted: 22 November 2022

Abstract: *This study aims at investigating the impact of Ye Enat Weg School Feeding Program on students' academic performance specifically on students' average test scores and student absenteeism from school among primary school children in Yeka sub-city, Addis Ababa. This study used both primary and secondary data sources. A multistage sampling technique was used to select respondents. Accordingly, 225 students (103 study and 122 control groups) were selected from grade 6 and 7 students of two primary schools using a structured questionnaire. In this study, both descriptive analysis and econometric models are used to analyze the data. The independent sample t-test result shows that there is a significant mean difference between beneficiaries and non-beneficiaries of the school feeding program in terms of average score and absent days before the application of matching methods. To estimate the impact of the program on students' academic performance Propensity Score Matching (PSM) model is applied with all four matching algorithms. Accordingly, the school feeding program significantly and positively impacted the average score of the study group. Regarding absent days, the impact of the school feeding program is significant in the Kernel matching method and stratification matching. ($p < 0.01$). The findings of this study call for the importance of ensuring the sustainability of the school feeding program.*

Keywords: impact, school feeding program, academic achievement, and absenteeism

[1] Lecturer, Yom Postgraduate College, Addis Ababa, Ethiopia. Corresponding Author E-mail: tedlahmariam@gmail.com
[2] Associate Professor, Center for Rural Development, College of Development Studies, Addis Ababa University.

Introduction

Globally 925 million people are estimated to be undernourished of which two-thirds live in just seven countries (Bangladesh, China, Congo, Ethiopia, India, Indonesia, and Pakistan). The proportion of undernourished people remains higher in Sub-Saharan Africa with a total contribution of about 239 million people from the total number of undernourished people at the global level (FAO, 2010).

Food For Education (FFE) is designed to promote increased enrollment and attendance and as a tool to reduce dropouts in chronically food-insecure districts in rural Ethiopia by providing a daily hot meal in schools. FFE meals additionally make it easy for children to concentrate on their work thus facilitating learning (WFP, 2011). As evidence, data show that school enrollment in Ethiopia increased by 3%, the attendance rate increased to 90 % and dropout rates fell to 8 % for girls and 9 % for boys in FFE intervention schools, which is lower than the national dropout rate of 14.6 percent for girls and 13 percent for boys (WFP, 2011).

However, hunger is still an obstacle to school participation for millions of children in Ethiopia (Desalegne Kaba, 2008). Households with low income are often not willing to send their children to school. The one who sends their children to school is also forced to withdraw them from school at an early age because of the heavy economic burden. Therefore, though primary school is free and compulsory in Ethiopia, many poor households are incapable of sending their children to school due to the hidden costs of education such as uniforms, books, and most importantly food. Therefore, School Feeding Programs are convenient means by which important nutrients can be provided for needy children in school. Ensuring that school children have food to eat helps them to concentrate in class rather than on their hunger. Del Rosso (1999) indicated that nutritional status and health have a strong positive impact on a child’s educational outcome in school therefore the school feeding

program is one alternative to address these challenges. Proponents of School Feeding Programs (SFP) claim that providing food in schools would attract vulnerable children to school, improves their attendance, and minimizes dropouts. According to the United Nations World Food Program, School Feeding Program is an incentive for vulnerable families to invest in children's education and encourages poor households to send children to school and helps to keep them there (WFP, 2008). SFP is known for its effectiveness in encouraging school enrollment, enhancing class attendance, and lowering the student dropout rate (Ahmed, 2004; WFP, 2009).

A school feeding program began in the 18th and 19th centuries in many European countries and the USA. For instance, in Germany, feeding students in school began in 1790, and in France, the school meal program for needy children began in 1867. In the USA, the Children's Aid Society of New York began serving lunches to children as far back as 1853 (Gunderson, 1971). The Netherlands was the first country to adopt national legislation to provide a meal to school children in 1900. Gunderson (2007) found that teachers supported school feeding because of better attendance, improved attention, and better scholastic work by the children. His findings and recommendation resulted in the Education Provision of Meals Act being passed in England in 1905 to secure suitable meals for schoolchildren.

In Ethiopia School feeding program (SFP) for first time began in 1994 with an initial pilot project covering 40 primary schools. The program was implemented by the Ethiopian Ministry of Education (MoE) in selected zones of four different regions, in collaboration with the United Nations World Food Program (WFP, 2008). The SFP is one of the strategies of education development incorporated in the government’s Education Sector Development Programs (ESDPs). Accordingly, SFPs are expected to raise and maintain school enrollment with a particular focus on meeting the demand side of education of vulnerable children (MoE, 2005).

Ye Enat Weg is a non-political, non-profit making indigenous humanitarian organization striving to ensure the quality of education in primary schools by supporting needy students in Addis Ababa City Administration. A School Feeding Program, a joint program by the office of the first lady of the country and *Ye Enat Weg,* a charitable association, was launched in February 2015 in 93 primary schools in Addis Ababa to serve 5,106 children, and in 2016 to feed over 20,000 children in 208 primary schools. 47 percent of the children are girls.

The program aims at improving the health and psychological well-being as well as the academic performance of young children exposed to malnutrition by giving priority to the most vulnerable ones through the mobilization of resources and fostering partnerships to this end. However, comprehensive studies have not been carried out to examine the impact of this program in considerably improving the academic performance of targeted students.

Food insecurity and hunger are daunting challenges in Ethiopia in general and in Addis Ababa in particular. The case is even more pronounced with vulnerable and powerless members of households, particularly women and children. Data obtained from the Addis Ababa City Administration Bureau of Education (2014) show that there are more than 20,824 primary school children who are in dire need of food, material, and emotional support in Addis Ababa. The majority of these students are orphans, children living with multiple disabilities, and HIV/AIDS.

According to the Ethiopian education and training policy, a regional examination will be given in grade 8 to certify the completion of primary education. Accordingly, in the 2013/14 academic year the promotion rate of students in PSLCE was only 67.64%. On the other hand, no improvement has been observed in both boys and girls concerning dropout and promotion rates of students over the years from 2010/11 to 2013/2014 (Education Statistics annual abstract, 2014/15). This could

be attributed to the economic and social background of families to support their children in their educational achievement by fulfilling all necessities in which the provision of well-nourished food for children is the prominent one.

According to Kaziranga *et al*. (2009), the interaction between nutrition and education can be generally understood in three ways. First, nutrition and health status influence the child's learning and his/her performance in school. That is, poor nutrition among children affects their cognitive function and hence reduces their ability to participate in learning activities at school. Second, children who are malnourished or who are unhealthy are unable to attend school regularly which in turn leads to poor academic performances. Third, hungry children encounter more difficulties to concentrate and performing complex tasks than well-nourished ones. Because poor children do not get the basic nutritional building blocks from birth, they will be unable to learn easily. Thus, School feeding could be seen as one of the key strategies in contributing to household food security and improving the academic performance of a child.

Several studies have investigated the relationship between school feeding programs and student academic performance. Adelman (2008) presents the interaction between school meals and school performance. He shows that this interaction works in two mechanisms. First, because school meals improve class attendance, children will spend more time learning in school. So, the more time children spend in school, the better they learn and this results in improved school performance. Second, school meals could alleviate hunger and encourage children to concentrate and learn better and their school performance improves. The study by Powel *et al* (1998) on 814 children in fifth grade in rural primary schools in Jamaica (where children were randomly assigned to receive breakfast at the individual level in the same classroom) found a small improvement in attendance rates for children receiving breakfast over the control group. Another study by Butternheim, A. et al. (2012)

was conducted on the impact evaluation of school feeding programs in three northern districts of Lao People's Democratic Republic using the difference in difference estimators with propensity score weighting to construct two plausible counterfactuals. However, they found minimal evidence that the school feeding schemes increased enrollment or improved children's nutritional status.

Ty M. Lawson (2012) carried out a systematic literature review of 26 studies done on the impact of school feeding programs on educational and agricultural development goals and found that school feeding programs conclusively impact the micronutrient level of targeted children, but have modest and mixed effects on health outcomes as evaluated by anthropometric measurements. Besides, the study found that while the impact of these interventions on the cognitive skills and abilities of students is still uncertain, there is strong evidence that school feeding programs positively affect school enrollment and attendance rates, especially for the girl.

Ahmed (2004) evaluated the impact of school meal support on student academic performance in Bangladesh as measured by achievement test scores of Grade 5 students. Using an econometric specification to isolate the effects of the program, he came up with a result that shows SFPs are effective in encouraging school enrollment, enhancing class attendance, and lowering student dropout in Bangladesh. Another study by Vermeersch and Kremer (2004) evaluated the impacts of School Feeding Programs on school Participation and achievement in Kenya and found that average school participation was 8.5 percentage points higher in the treatment group than in the control group they also administered two attainment tests, one oral and one written two years after the introduction of the in-school meals program. They found that school meals increased test scores in schools where the teacher was experienced. This result was found by regressing the test score on both a treatment variable as well as a treatment variable that interacted with the teacher's experience. Similarly, Mkanyika and Agripina Mwavula

(2014) studied the influence of school feeding programs on pupils' participation in public primary schools in flood-prone areas of Garsen division, Tana Delta district, Kenya using the descriptive analysis technique. From a sample of 12 head teachers, 48 teachers, and 288 pupils, the study found established that the school feeding program has enhanced the enrollment, attendance, and participation of pupils in the class.

In Ethiopia, however, studies conducted on the impact of school feeding programs are limited. The existing few studies also show mixed results on the effect of school feeding programs. Desalegne Keba (2011) studied the impact of school feeding programs on school participation with evidence from the Sidama zone of Southern Ethiopia. He found no significant positive impact of the School Feeding Program on any of the three school participation indicators namely enrollment, attendance, and drop-out in the Sidama zone of Southern Nations and Nationalities Region, Ethiopia. Besides, Gutama Mokonnen (2017) carried out a study on the nutritional status and school performance of children who benefited from the School feeding program in Selected Elementary Schools, Arada Sub-City, Addis Ababa employing comparative descriptive analysis. He found that Hemoglobin level was improved by the school feeding program and living in a large family size, low socio-economic status of the parents or guardian, inadequate amount of nutrients in food supplied, anemia, and malnutrition were the causes of poor academic performance. However, he showed that the nutrient content and the energy supplied to the children through school feeding were below the recommended dietary allowance. Moreover, Abiy Yohannes (2017) analyzed the effect of the school feeding program on the school performance of the primary public school in Arada Sub-City, Addis Ababa. Applying the regression model and statistical tests, he found that the effect of the School Feeding Program on academic achievement, children's attention measures, and attendance are not significant. However, these studies were not able to systematically net out the impact of school feeding programs on the academic performance

of students using appropriate econometric models, particularly in Addis Ababa where the school feeding program interventions are pervasive.

In most impact assessment studies, where the econometric estimation methods were applied in estimating program impact, parametric estimation methods have been commonly used to capture the impact of the program on the outcome of interest which has many limitations in attributing the impact of the program. Owing to such methodological and internal validity gap the study will use Propensity Score Matching of impact evaluation to measure the impact of school feeding programs on students' academic performance to ascertain the claim that measured the differences in academic performance outcomes of students treated by the intervention are caused by the program.

To the best of our knowledge, no study has been carried out to analyze the impact of SFP intervention by "Ye Enat Weg" charitable organization on students' academic performance in Addis Ababa. Thus, to fill these gaps, the study, analyzed the impact of the school feeding program on the average score and school attendance of grade six and seven students by using the propensity score matching method.

Methodology

Study Design

The study follows a Quasi-experimental research design With *Ye Enat Weg School* feeding program participant/beneficiary children as a treatment group and non-participants as a control group. Quasi-experiments are studies that aim to evaluate interventions or cause-and-effect relationships due to interventions by using criteria other than randomization. The technique compares students within the program (treatment groups) and those who did not participate in the program (control groups), as a way to measure and single out the impacts of the SFP on students' academic performance. Accordingly, the technique

uses counterfactual reasoning, that is, what the outcome would have been for program participants had they not participated in the program. In other words, it assumes that both students with control and program intervention have similar characteristics before the intervention, and any observed difference between the two groups after the intervention is attributed to the effect of the program.

Sampling Procedure and technique of the study

The study employed a five-stage sampling procedure. In the first stage, Yeka sub-city was selected randomly from the ten sub-cities of Addis Ababa, where Ye Enat Weg School Feeding Program has been practiced. In the second stage, two schools namely Salayshe and Karalo were selected from Yeka sub-city public primary schools purposely based on the population of beneficiary children. In these two schools, there are large beneficiaries of the program so it would be easier to sample beneficiary students and undertake impact evaluation successfully. In the third stage, grades 6 and 7 students were purposively included in the study and a cross-sectional survey was undertaken between December 18, 2016, and January 15, 2017. The main reason for this is grades 6 and 7 students have a better experience than lower grades such as Grades 3, 4, and 5 students, and grades with a high number of beneficiary students have been given priority for the selection. To identify the sample size for the study, Yamane's (1967) sample size calculation formula is used.

$$N = \frac{N}{1 + Ne^2}$$

The target population was 1170 students of grades 6 and 7 in the selected primary schools. Assuming a 6% level of error, the sample size required is calculated as:

$$N = \frac{1170}{1+1170(0.0036)} = 225$$

Based on the formula, the sample size for this study is equal to 225. Accordingly, in the fourth stage, the stratified sampling technique is used to categorize students into participants and non-participants of the school feeding program and allocate the determined sample size, that is 225, into the two groups since the aim of the study is impact evaluation and hence imperative to do that by design. Therefore, for this study, all 103 beneficiary students of the school feeding program in grades 6 and 7 were taken as the treatment group and the rest 122 sample students from the same grades were taken as a control group. In the final stage, students who were taken as the control group were selected randomly from students who are listed as reserves in the school feeding program of Salayshe primary school. But, in the case of Karalo primary school, the control group students were selected randomly from the non-beneficiary students of grades 6 and 7 as the second-best alternative since reserves are not available. This has been done to find the best counterfactual group for the treated group so that matching quality for impact evaluation would be fairly high.

Instruments

To collect data for this study, the researcher used different instruments. These include Questionnaires for the HH survey, key informant interviews, and document analysis. Questionnaires were pilot tested to improve quality and clarity. Accordingly, a survey using structured questionnaires was employed for students and parents/caregivers of both beneficiary and control groups separately (the first part for students and the second part is devoted to parents/caregivers) to capture their general demographic data, socio-economic status, and academic level. In addition, semi-structured key informant interviews were employed to explore the beneficiary selection criteria and the effect of the program on student academic performance. The key informants include school principals and selected beneficiary students with availability and convenience sampling techniques respectively to get additional views about the school feeding program and its outcomes. Finally, documents

obtained from the schools were taken as secondary sources. These are Lists of grades 6 and 7 students from the two sampled schools containing their name, sex age, total scores for the academic year averaged over the two semesters, and school attendance. These documents were obtained from official school documents with the help of the school directors.

Methods of Data Analysis

All data were entered into a computer using SPPS version 20 software by the researcher. After the data were edited and cleaned, they were analyzed in the following manner.

First, descriptive statistics, such as means and standard deviations, were used to describe the general characteristics of respondents and provide an overview of the data set.

Second, since Participation in SFP is non-randomized and the baseline survey was not conducted before the intervention of the project the study used the propensity score matching method (PSM) to assess the average impact of *Ye Enat Weg School* feeding program on the academic performance of the beneficiary students.

Moreover, data from the Key informant interview were analyzed and integrated into the findings of the quantitative data to strengthen the results and discussions.

The Theoretical Framework: Propensity Score Matching (PSM)

Propensity Score Matching constructs a statistical comparison group then based on a model of the probability of participating in the treatment using observation characteristics. The degree of similarities between different units is measured based on the probability of being exposed to the intervention given a set of observable characteristics not affected by

the program. In PSM, two important calculations are particularly carried out to show the impact of the treatment and useful to define them here: Average Treatment Effect (ATE) and Treatment on the Treated (TOT) or also known as the Average Treatment Effect on the Treated (ATT). Following the definition of Khandker et al (2010), the average treatment effect (ATE) of the intervention is calculated as the mean effect of the treatment can then be calculated as the average difference in outcomes between the treated and non-treated units after matching across treated and control groups. In other words, the Average Treatment Effect (ATE) is the impact of the program estimated by everyone (both those who actually enroll and those who do not or the entire population under consideration). On the other hand, Treatment on the Treated (TOT) or also known as the average treatment effect on the treated (ATT) is the impact of the program estimated on those who were offered treatment and who enroll.

This propensity value is estimated based on a statistical model, e.g., logit or probit model, and thereby estimates the average treatment effect of the outcome difference between the two groups using nearest-neighbor, caliper, stratification, and kernel matching. Propensity score matching is more robust, but it requires a large sample size and good-quality data. In addition, it may not able to control all preexisting differences between the two groups (Pufahl and Weiss 2009).

Assumption of Conditional independence (CIA)

Conditional independence states, that given a set of independent observable X that are not affected by the intervention (treatment) potential outcomes Y are independent of treatment assignment T. If y_i^T Represents outcome for participants and y_i^C Represents the outcome from non-participants, conditional independence implies

$$y_i^T y_i^C \perp T_i \; / \; X_i \tag{1}$$

Where $\perp$ indicates Independency, X is a set of observational characteristics.

Rosenbaum and Rubin (1983), this assumption is also called unconfoundedness and it implies that uptake of the program is based entirely on observed characteristics. To estimate the Treatment on the treated (TOT) as opposed to the Average Treatment Effect (ATE), a weaker assumption is needed:

$$y_i^C \perp T_i \; / \; X_i \quad (2)$$

Assumption of common support

Assumption of common support, this assumption requires that there needs to be a region of common area where households with the same characteristics have a probability of being both participants and non-participants (Gertler*et al, (*2011) and Khandker*et al*, (2010). Treatment units, therefore have to be similar to non-treatment units in terms of observed characteristics unaffected by participation; thus, the common support assumption implies that the probability of receiving treatment for each possible value of the vector X is strictly within the unit interval that falls outside the region of common support area would be dropped. (Baum, 2013**)** Mathematically, it is represented by: for each value of Xi, there is a positive probability of being both treated and untreated

$$0 < P (Ti = 1/Xi) < 1 \quad (3)$$

This assumption improves the quality of matches as it excludes the tails of the distribution of (X). If there is a sizable overlap in PS between participants and nonparticipants, PSM estimates TOT as the average Mean difference in the possible outcome (Y) within the common support region. It weights the comparison unit by the PS distribution of

participation. The cross-section is estimated as follows. (Khandker*et al*, 2010)

TOT_{PSM} = $E_{p(x)|T=1}$ {E [Y^T| T = 1, P (x)] – E [Y^c | T = 0, P (X)]} (4)

More clearly, the treatment effect with cross-section data and within the common support can be written as follows (Heckman, Inchimura, and Todd 1997, Smith and Todd 2005).

$$TOT_{PSM} = \frac{1}{N_T} [\sum_{i \in T} Y_i^T - \sum_{j \in c}(\omega)(i,j)\ Y_j^c \quad] \quad (5)$$

Where $N_T$is the number of participants i and (ω) (i, j) is the weight used for the aggregated outcome for the matched nonparticipants j^2.

Variables Definition and Measurement

✓ *Outcome variables (Impact indicator variables)*

Outcome variables are variables that resulted from participation in the SFP. In this study Student's average scores in the academic year and Class attendance in terms of absent days were taken as an impact indicator variable associated with SFP benefits.

Average Score: This is the average score of grade 6 and 7 students in both groups (SFP beneficiaries and non-beneficiaries). This was taken from two schools for the sampled Yeka sub-city average score is used as an indicator of academic achievement Students who benefited from the SFP have a similar or better average score than the non-benefited student.

Class Attendance: This is the class attendance of the student in terms of absent days. This is also taken for both groups (SFP beneficiaries and non-beneficiaries) from two schools for the sampled Yeka sub-city. Students who benefited from the SFP have better class attendance or low absent days than non-benefited students.

✓ *Dependent Variable:*

Participation in School feeding (SF): The dependent variable in this study is the student's treatment in the SFP. It takes value 1 if the student got the intervention (treated in SFP) and takes 0 if the student didn't get treatment in the SFP.

✓ *Covariates for Propensity Score Matching*

Sex of student (SEXS): This refers to a dummy for the sex of the student from both treated and control groups and it takes the value 0 if the sample respondent is male, and 1 if the sample respondent is Female.

Age of student: a discrete variable refers to the age of the student in years.

*Age of the household head (AGEHH)***:** It is a continuous variable and is defined as the age in years.

*Sex of the HH head***:** This refers to a dummy for the sex of the household head and it takes the value 0 if the head is male and 1 if the head is female.

*HH head education level (HHEDU)**:*** Educational level of the parent (Father and mother) is supposed to have a possible impact on their child's academic performance. This is the highest grade level completed by the household head.

Siblings' education level (SIBEDU): This is the highest grade level completed by the Siblings.

Family size (famsis): It refers to the number of total household members who live and consume from the same household.

Ownership of Home: It is a dummy variable and takes a value of 1 if yes, and 0 otherwise**.**

Participation in school clubs (PARCLU): It is a dummy variable and takes a value of 1 if yes, 0 otherwise.

Child health condition (CHDHELTH): is the health condition of the student measured as a dummy variable. It takes the value of 1 if he or she is suffering from repetitive health problems and 0 otherwise.

Attending tutorial class (TUTCLA): attending tutorial classes may affect the academic performance of students. It is taken as a binary variable 1 represents tutorial-attending students and 0 is for the non-attending student.

Marriage (MARI): the status of parents living together or not may affect their child's academic performance. If the parents are not living together, it may affect the child's academic performance. It is generated as a binary variable, 1 living together parents and 0 otherwise.

Studying hour (STHR): the amount of time that the student spends studying after school may affect his/her academic score. It is a continuous variable that measures the amount of time he/she spends studying in a week.

*Domestic work hour (DWH***):** The amount of time that the student spends to help his/her parents is supposed to affect the academic performance of the student. Students are engaging in different activities after their

school time. Their degree of spending their time on household work activities is different. This may bring significant differences on students' academic performance. It is measured by taking the amount of time they spent to help their parents.

Family economic status/income (FAMINC): one of the variables expected to influence the academic performance of the student is his/her parent's level of income it is a continuous variable that took the monthly income of the parents.

Results and Discussion

The impact of *Ye Enat Weg School* feeding program has been discussed in terms of average scores and absent days. The sampled student's demographic characteristics' including their academic status and their household socio-economic and demographic characteristics are presented via statistical tools. Both descriptive statistics and econometric model (propensity score matching) results are discussed to analyze whether there is a significant difference between SFP beneficiaries and non-beneficiaries in terms of average score and absent days. Table 1 shows the respondent's characteristics.

Household heads' characteristics

The survey result presented in Table 4.1 below shows that the household heads of the study have a mean age of 42.8 with a standard deviation of plus or minus 7.6. The income status of the respondent household heads shows a huge variability ranging from an average monthly income of 400 ETB Birr to that of 5000 ETH Birr.

Table 1: *Summary statistics of household head (HHH) characteristics*

Variable	Obs.	Mean	Std. Dev.	Min	Max
Age of the HHH	225	42.71556	7.600457	30	65
Average monthly income of HHH	225	1585.676	882.8918	400	5000
Educational status of the HHH	225	3.964444	4.427852	0	16
Family size	225	5.017778	1.581038	2	10
Average HHH educational status	225	8.337778	2.440661	6	14

Source: Own survey result, 2016

The result of the survey also shows that 48.4% (N=109) of the household heads are illiterate with no formal educational background and the rest 51.6% (N=116) have at least attained some level of formal education. The mean educational level of 3.9 with an SD of 4.4 displayed in Table 1 further indicates that most of the household heads have not completed their first cycle of primary education. On the other hand, the average educational status for the whole family members was 8.3 with an SD of 2.4 showing that most of the family members have joined and completed their second cycle of primary school education.

The household heads' characteristics in Table 1 also point out that the family size of the respondents ranges from 2 to that of a family with 10 members living together. The average family size is 5.

Table 2: *Descriptive Statistics of Sample Households (For Continuous Variables)*

	Control (N=122)		Treated (N=103)		Difference	T-test
Variable	**Mean**	**STD**	**Mean**	**STD**	**Mean**	
Age head	43.418	8.27307	41.884	6.66172	1.53454	1.5132
Edu head year	5.37705	4.72435	2.2913	3.37125	3.08579	5.5429***
Fam size	5.2541	1.53505	4.7379	1.59633	0.51623	2.4677***
HYSCS	8.70492	2.66191	7.9029	2.07938	0.80201	2.4839***

*Remark *** means significant at the 1% probability levels*

Table 2 above shows, the mean differences between the treated and non-treated were significant for the educational level of the household heads, family size, and educational level of siblings.

On average, the educational level of the treated student's household head was 2.2 years. While the educational level of control students' household head on average was 5.3 years. The mean difference in the educational level of the household heads between the treated and control groups was 3 years. The mean difference is statistically significant at the 1 % level. Therefore, treated student household heads were less educated than the control student household heads.

The mean family size of the treated student's household head was 4.7 and the maximum number of household size was 10. While the mean family size of the control students' household head was 5.2 and the maximum number of the HH size was 9. The mean difference in the family size between the treated and the control group was 0.5. The mean difference is statistically significant at the 1 % level. That is when compared to the control group the treated group has fewer family sizes. As one can see from Table 2 the mean year of schooling completed by siblings in the treated group on average was 7.9 years. While, the mean

year of schooling completed by the control group siblings, on average was 8.7 years. The mean difference of the highest year of schooling completed by siblings between the treated and the control group was 0.8. The mean difference is statistically significant at the 1 % level. However, the age of the household head is not statistically significant (p>0.1) between treated and non-treated students.

Table 3: *Descriptive statistics of students' characteristics (for dummy variables)*

Variables	Category	Control		Treated		χ2	p-value
		N=122		N=103			
		N	**%**	**N**	**%**		
Sex of the student	F	35	29	26	61	0.3566	0.562
	M	87	71	77	39		
Orphan	Yes	33	27	58	56	19.853	0.000***
	No	89	73	45	47		
Co-curricular participation	Yes	68	56	69	67	2.9695	0.085*
	No	54	44	34	33		

Source: Own survey result, 2016

**** and * means significant at the 1%, and10% probability levels, respectively*

Table 3 presents the level of participation that existed among different categories of students' characteristics with an x^2 test of independence to understand the presence of significant dependence between treatment and students' characteristics. Accordingly, based on Pearson's chi-square test for categorical variables, a statistically significant difference (p<0.01) exists between the treated and control group on the variable orphan. As can be seen from table 3 orphan students are more likely to participate in the treatment with a

participation of 56%. The x^2 test of independence also signifies the fact that treatment in the school feeding program is dependent on student co-curricular participation at the 10% level. However, the sex of the student is not statistically significant ($p>0.1$) between treated and non-treated students.

Two-sample T-test on outcome variables before matching

Two sample t-test has been employed to check whether there is a significant difference between treated and non-treated groups regarding academic performance variables. A two-sample t-test is checked if there is a significant difference in covariate means for both groups. (Rosenbaum and Rubin, 1985). We expect differences before matching, but the covariance should be balanced after matching in both groups and a significant difference should not be found.

Two-sample t-test on Average score and absent days

The data were subjected to a t-test to check whether or not the school feeding program is significantly related to academic performance. Table 4 below shows the treatment and control students with their average scores and absent days from the school in the academic year. The control group students' average mark is 2.60% less than the treatment group. This difference is significant at the 5% level. Therefore, treated students (Mean=65. 76, SD=9. 3) were better in their academic performance than control students (Mean=63.17, SD=7.9). The t-test (t= -2.2544 at 0.05 level) indicates that there is a significant mean difference in academic achievements between treated and control students. In terms of absent days from school, the mean difference of 0.377247 shows that the number of absent days from school to the school feeding beneficiary students was 37% less than the control group students. As the t-test value (t= 3.6532) indicated the difference is statistically significant at 1%.

Average score and absent days between treated and control students

The average scores are obtained from official school records and represent the average of scores from all school subjects total scores for the academic year averaged over the two semesters. The absent days are obtained from students' attendance at the schools.

Table 4: *Average score and absent days between treated and control students*

Average score	Obs.	Mean	Std. Err	Std. Dev	T-value
Control	122	63.17	0.717353	7.9	-2.2544
Treated	103	65.76	0.918769	9.3	
Diff		-2.59213			
Absent days					
Control	83	0.690887	0.069317	0.631509	3.6532
Treated	51	0.31364	0.067922	0.485062	
Diff		0.377247			

Source: Own survey result, 2016

Econometric Estimation results

The Probit regression model was used to estimate propensity scores for matching the treated with control children. In this study participation in the school feeding program is the dependent variable and takes the value 1 if the children are the beneficiaries of the program and 0 otherwise.

Looking into the estimated coefficients (Table 5), the results indicate that SFP program participation is significantly influenced by two explanatory variables. The educational level of household heads and family support are significant variables that affect the participation of the household in

the program. Students with a lower educational level head are more likely to be included in the program than those students who have a more educated household head. Similarly, students who do have family support are less likely to participate in the SFP intervention than students who have no family support.

Table 5: *Determinants of SFP Participation Using the Probit Model*

Covariates	**Coef.**	**Std. Err.**	**Z**
Age head	-.0096126	0.020555	-0.78
Edu head year	-.1096481	0.037424	-4.99***
Fam size	-.0664916	0.10554	-1.04
Family support	-.5392037	0.396256	-2.24**
HYSCS	.0134136	0.077185	0.29
Tutorial	.160145	0.320066	0.83
Late com	.0001628	0.318694	0.04
_cons	1.70918	1.658442	1.04
N	225		
LR chi2(7)	43.29		
Prob > chi2	0.0000		
Log-likelihood	-133.50988		
Pseudo R2	0.1395		

Source: Own survey result, 2016

*Note: *** and ** mean significance at 1% and 5% levels respectively*

Distribution of Propensity Score Matching

Once the propensity score has been estimated based on the probit regression model, the distribution of the treated and the control group must be similar, this similarity resulted in the considerably wider area in the common support region.

Figure 1 below differentiates the region of common support using color codes. The upper green color indicates the treated-off support observations. The upper red one indicates the treated on support and the lower blue color indicates the untreated off support. Thus, most of the observations are in the common support region of the region [.10759133, .77647996]. This ensured that there is sufficient overlap in the characteristics of treated and untreated units to find adequate matches (Bawm, 2013). Hence, the common support assumption has been maintained.

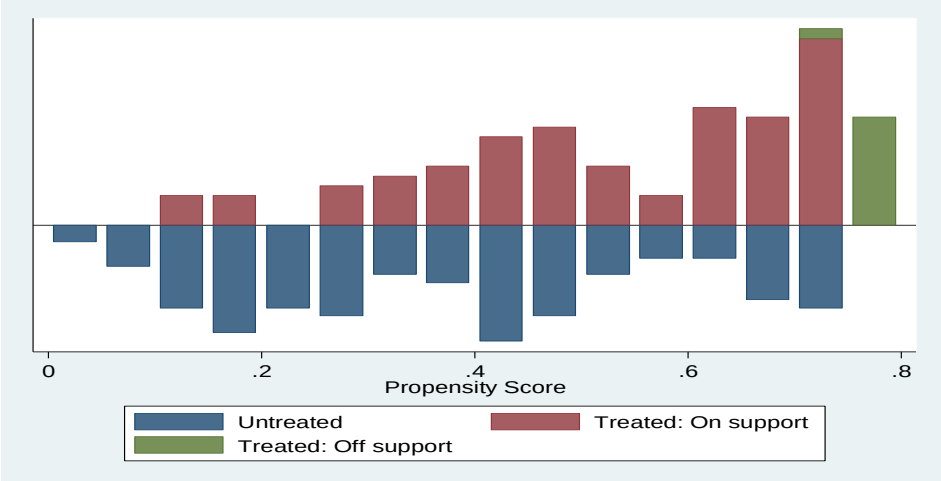

Figure 1: Histogram of propensity scores with common (off) support regions

Source: own survey results in 2016

Table 6 below, describes the common support of the untreated and treated group for the outcome variables. Accordingly, 12 students, or 11.6% of the observations are off-support. While 213 observations (94.6%) are on support from both the treated and control groups.

Regarding the treated groups, 11.6% of the observations are off-support and 94.6% are on-support. While from the control group all observations are on support. This means the off-support observation is discarded from the treated group. The decisions for the off and on-support observations are based on the summarized *scores* in the treatment and control groups and count how many units are off-support.

From the estimated propensity score, we can see that the length of the common support region is [.10759133, .77647996]. Observations that are less than the minimum common support value (.10759133) are off-support values and discarded from the region. Similarly, observations that are greater than the maximum common support value (.77647996) are discarded from matching.

Table 6: *Common Support Region*

	Average score			**Absent days**		
	Off	**On**	**Total**	**Off**	**On**	**Total**
Untreated	0	122	122	0	122	122
Treated	12	91	103	12	91	103

Source: Own survey result, 2016

Each treated unit is matched only with the control units whose propensity score falls into a predefined common support region of the propensity score matching. As we can see from the ATET result (see Table 7) on a common support region, the SFP-treated students' average mark is 4.17 points greater than the control group students, significant at 1%.

Regarding absent days from school, as we can see from the ATET result, the school feeding program beneficiary students' absent day of school was less by 68% when compared with the control group students. The difference is statistically significant at 1%.

Table 7: *ATET within the Common Support Region*

Variable	Sample	Treated	Control	Difference	S.e	T-stat
Average score	Unmatched	65.7641748	63.1720492	2.59212558	1.14979501	2.25
	ATET	65.9082418	61.732967	4.17527473	1.55105168	2.69
Absenteeism	Unmatched	0.776699029	1.66393443	-0.887235397	0.200183246	-4.43
	ATET	0.835164835	1.51648352	-0.681318681	0.281252893	-2.42

Source: Own survey result, 2016

The Impact of School Feeding Programs on Students' Average Score

To estimate the average treatment effect of the school feeding program on the beneficiaries (treated group) different matching algorithms were used. These include nearest-neighbor matching ("attnd"), stratification or interval matching ("atts"), and Kernel matching ("attk").

As indicated in table 8 below, we have 156 matched observations in the nearest neighbor matching method, 214 in kernel matching method, and 214 in the stratification or interval matching method.

The propensity scores matching result shows that students' participation in the school feeding program has a significant effect on their average score as the critical values are 2.003, 2.857, and 2.821 for "attnd", "attk" and "atts" matching methods respectively. Accordingly, the average score for treated students in the school feeding program is higher than the non-treated students by 3.65, 3.58, and 3.68 points in nearest neighbor matching (NNM), kernel matching (KM), and in stratification matching (SM) respectively. The ATET is significant at the 1 % level in

stratification matching and Kernel matching, and at the 5% level for nearest neighbor matching. Therefore, the study chooses SM and KM matching methods as per large matched sample size is preferable. The average treatment effect on the treated group ranges from 3.58 average points in the Kernel Matching method to 3.68 average points in the Stratification matching method. This means on average, the academic performance of school feeding program beneficiary students, as measured by average score has increased by 3.58 – 3.68 average points in the academic year. This indicates that the school feeding program has brought a significant impact on the beneficiary students' average scores.

In terms of the impact of school feeding programs on students' absenteeism in the academic year, the propensity score matching result shows that student's participation in the school feeding program has a significant effect on their absenteeism from the school as the critical values are 4.483, 3.775 for "attk" and "atts" matching methods respectively. However, "attnd", shows that there is no statistically significant difference between treated and non-treated students in terms of absenteeism as the t-value is 1.452. Accordingly, the average absenteeism for treated students in the school feeding program is lower than the non-treated students by 54.4%, 89.6%, and 87.4% in nearest neighbor matching (NNM) kernel matching (KM) and in stratification matching (SM) respectively. The ATET is significant at the 1 % level in kernel matching and stratification matching. However, the study chooses SM and KM matching methods as per large matched sample size is preferable. The average treatment effect on the treated group ranges from 87.4% in the Stratification Matching method to 89.6% in the Kernel matching method. This means on average, the academic performance of school feeding program beneficiary students, as measured by reduction in absenteeism has been decreased by 87.4% to 89.6% in the academic year as compared to non-treated students. This indicates that the school feeding program has brought a significant impact on the beneficiary students' average absent days.

Table 8: *Average Treatment Effect on Average Score and Absent Days*

Average score Matching methods	**Number of treatments**	**Number of controls**	**ATET**	**Standard Error**	**T**
Nearest neighbor matching	103	53	3.652**	1.823	2.003
Kernel matching	103	111	3.585***	1.255	2.857
Stratification or interval matching	103	111	3.687***	1.307	2.821
Absent days Matching methods					
Nearest neighbor matching	103	53	0.544	0.374	-1.452
Kernel matching	103	111	0.896***	0.203	-4.483
Stratification or interval matching	103	111	0.874***	0.232	-3.775

Source: Own survey result, 2016

*Remark: ***, ** and *means significant at 1%, 5% and 10% significance levels respectively*

Checking the Robustness of Average treatment effect

One way to check robustness is to apply direct nearest-neighbor matching instead of estimating the propensity score equation first. Stata has the command ("nnmatch") to do that. If both methods have given similar results, then the findings are assumed to be more reliable (Khandker et al.,2010). This study has used both robustness check mechanism which is the different matching methods and "nnmatch". Accordingly, the results of ATET significantly affected (higher t- value) outcome variables are somewhat consistent as it is summarized by the three matching methods and the result of "nnmatch" the value of Z is greater than two and the p-value is zero this indicates that the outcome variables are significant at 1% level. The result shows the model propensity score matching was strong.

Table 11*: Summary Table Showing Robustness Check*

Outcome variables	Matching Algorithms	ATET
Average score	Nearest-neighbor matching	3.652
Average score	Kernel matching	3.585
Average score	Stratification matching	3.687
Absent days	Nearest-neighbor matching	-0.544
Absent days	Kernel matching	-0.896
Absent days	Stratification matching	-0.874

Source: Own survey result, 2016

Balancing Test for Propensity Scores and Covariates

According to the balancing test for propensity scores and covariates, the t values of all the covariates are not statistically significant, which means after matching the difference between the means of the treatments and the comparison groups has been minimized. Therefore, we can justify that the matching quality or balancing of the propensity score for all covariates has been satisfied.

Test for joint significance

In this context, the chi-square test is a joint test for the equality of means between treatment and comparison units for all the covariates. The result signifies that there is a fairly low pseudo R2 value and nonsignificant likelihood ratio (LR) test, hence after matching; there is a nonsignificant mean difference between the two groups as is shown in the mean bias, which is 3.6. Based on formulae from Rosenbaum and Rubin (1985), the standardized bias before and after matching, the mean bias should be less than 5 after matching.

From the whole balancing test result, one can deduce that after matching the distributions of covariates have no significant difference for both treated and control groups and it is trustworthy to estimate treatment effects based on the available data set and the chosen matching algorithm.

Table 13: *Chi-Square Test for Joint Significance*

Ps R2	LR	Chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.003		0.75	0.998	3.6	3.9	12	0.98	0

Source: Own survey result 2016

Discussion Of the Findings of Key Informant Interview

In a key informant interview (KII) two key informants from school principals and two key informants from beneficiary students were interviewed. Similar, to the findings of the quantitative study, key informant interview members confirmed that the introduction of the school feeding program has increased students' academic performance.

The key informants expressed concern about the quality of the meal provided. They suggested the provision of milk along with the meal. And thought that a greater variety of food should be provided by the program.

In addition, there is a problem of shelter for cooking and feeding the children in surveyed schools with fulfilled chairs and tables.

Finally, the KII shows that the school meals are provided early in the morning, thus children who came late remain hungry during the first half of the school day.

Summary and Conclusions

Cross-sectional data were gathered using semi-structured questionnaires from the sample of 103 beneficiaries and 122 nonbeneficiary children and their households. The study evaluates the impact of the school feeding program in enhancing the academic performance of primary school children of Salayshe and Carallo primary schools in Yeka sub-city Addis Ababa. The result shows that the school feeding program has significantly impacted students' academic performance.

The main research question of the study was to evaluate the impact of the school feeding program in enhancing the academic performance of primary school children. Answering this question requires observing outcomes with-and-without the program for the same household. However, it is impossible to observe the same object in two states simultaneously. While the program evaluator observes the facts for an object, it is impossible to observe the counterfactual for the same object.

Hence, the study has applied a propensity score matching technique which has become the most widely applied non-experimental tool for the impact evaluation of social programs. It is used to extract a comparable pair of treatment-comparison households in a non-random program setup and the absence of baseline data. Moreover, it can adjust for (but not solve the problem of) selection bias and in estimating the counterfactual effects.

The contribution of the program in promoting education has been thoroughly assessed. Hence, the descriptive analysis result shows that statistically there is a significant difference between the beneficiary and non-beneficiary children in terms of average score and absent days. Beneficiary students have lower absent days and higher average scores than non-beneficiary students.

The result of the propensity score matching method shows that there is a significant difference between beneficiaries (treatments) and non-beneficiaries (controls) in terms of educational outcome variables: average score and absent days.

The t-test result of the impact of the school feeding program before matching showed that the difference between the treated and non-treated students in terms of the outcome variables (average score and absent days) are statistically significant at 5% and 1% levels respectively.

Based on ATET (average treatment effect on the treated) results after matching, the study established that there is an increase in student average scores and decreasing in absent days as compared to non-treated students. The difference between the two groups in terms of the outcome variables (average score and absent days) was statistically significant.

Accordingly, participation in the SFP increased the average score of the student by 3.58% - 3.68% on average as compared to the control group. The average absent days of the student who benefited from the program has been reduced by 87.4% - 89.6% on average as compared to the control group. That means, the school feeding program benefited students attending their class with relatively lower absent days than the non-participants.

Finally, this study concludes that the school feeding program has brought an impact on improving student average scores and reducing absent days from school as it is verified by the analysis result.

Recommendations

Based on the empirical results obtained from the study the following recommendations have been forwarded for the better academic performance of vulnerable children in the Yeka sub-city.

- The assessment of household demographics reveals both SFP-treated and non-treated households exist in a similar socioeconomic environment. Hence, it is recommended that the school feeding program could be scaled up to reach vulnerable nontreated students as well. However, the targeting criteria and mechanisms should ensure only vulnerable children and communities are reached. This is because resources are limited in poor countries like Ethiopia. So effective targeting is necessary.
- The overall findings of my study suggest that the school feeding program has a significant positive impact on students' average scores and absenteeism. Hence, it is recommended that social fundraising systems should be designed to mobilize resources and address all food-insecure students to improve student academic performance.
- The sustainability of the school feeding program is very crucial. Therefore, liaising with federal and Addis Ababa city administration is necessary to draw more attention, commitment, and resource to the nutrition agenda.
- In the long term to solve the problem of food insecure students permanently, poverty needs to be addressed by intervening in the households. In this regard, efforts have to be made by the government and non-government organizations to address the livelihood needs of the dwellers of the city to sustainably respond to the problem of food insecurity.
- Based on key informant interviews a variety of food may be provided by the program along with milk. Therefore, program administrators should look for ways to improve the quality of school meals if the objectives are to be satisfactorily achieved. To this end, the School Feeding Programs need to be designed as part of an effective package

of interventions that address the nutrition and health needs of school-age children.

References

Abiy Yohannes (2017). The Effect of School Feeding Program on the School Performance of Primary Public School in Arada Sub-City, Addis Ababa, Master Thesis, School of Social Work, Addis Ababa University.

Adelman, S.W., Gilligan, D.O., & Lehrer, K. (2008), How Effective Are Food for Education programs? A Critical Assessment of the Evidence from Developing Countries. Washington, D.C, International Food Policy Research Institute.

Ahmed, A. U. (2004). Impact of Feeding Children in School: Evidence from Bangladesh. Washington D.C, International Food Policy Research Institute.

Ahmed, A. U., & delNinno, C. (2002). The Food for Education Program in Bangladesh: An Evaluation of Its Impact on Educational Attainment and Food Security. Washington, D.C., International Food Policy Research Institute.

Butternheim, A, Alderman, H. and Friedman, J. (2012). Impact Evaluation of School Feeding Programs in Lao PDR, Policy Research Working Papers, Open Knowledge Repository, World Bank Group.

Caldes, N. and A.U. Ahmed (2004) Food for Education: A Review of Program Impact. Washington, D.C. International Food Policy Research Institute.

Caliendo, M., and Kopeinig, S. (2008). Some Practical Guidance for the Implementation of Propensity Score Matching. IZA Discussion Paper No. 1588, University of Cologne.

Del Rosso, J. M. (1999). School Feeding Programs: Improving Effectiveness and Increasing the Benefit to Education. A Guide for Program Managers.

Desalegne Keba (2011). Education in Focus: Impacts of School Feeding Programme on School Participation: A Case Study in Dara Woreda of Sidama Zone, Southern Ethiopia (unpublished) M.A thesis, the Norwegian University of Lif VCe Sciences. Norway.

Gunderson, G. W. (1971). The National School Lunch Programs -- Background and Development. Washington, D.C.: U.S. Department of Agriculture.

Guta (2014). Assessment of the Difference of School Feeding Programme on School Participation Among Primary School Children in Bishoftu Town, East Shoa Zone Oromia Regional State (unpublished) M.A thesis, Addis Ababa University.

Gutama Mokonnen (2017). Nutritional Status and School Performance of Children Benefited from School Feeding Program in Selected Elementary School, Arada Sub-City, Addis Ababa, Ethiopia. Master Thesis, Center of Food Science and Nutrition, Addis Ababa University.

Heckman, J.J., Ichimura, H. and Todd, P., (1997). Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme, *The Review of Economic Studies.*

Jalan, J. and Ravallion, M. (2003). Estimating The Benefit Incidence of An Antipoverty Program by Propensity-Score Matching. *Journal of Business and Economics Statistics*, 21(1):19-30

John, K. (2013). Effects of School Feeding Program by Non-Governmental Organizations on Access to Education in Public Primary Schools in Drought-Stricken Kakuzi Division, Kiambu Country, Kenya.

Mkanyika, Agripina Mwavula (2014).The Influence of School Feeding Program on Pupils Participation in Public Primary Schools in Flood-Prone Areas of Garsen Division, Tana Delta District, Kenya. Masters' Thesis, Department of Educational Foundations, University of Nairobi.

Ministry of Education (2010/11). Education Sector Development Program IV. Addis Ababa.

MoE (2005). Education Sector Development Program III. Addis Ababa, Ministry of Education.

MoE (2014/15). Addis Ababa Education Bureau Annual Abstract

MoFED (Ministry of Finance and Economic Development) (2006). Building on progress: - Google Search. (n.d.). Retrieved December 15, 2022, from https://www.google.com/search

MoPED (Ministry of Planning and Economic Development) (1993). An Economic Development Plan for Accelerated and Sustained Development to End Poverty (PASDEP). Addis Ababa, Ethiopia.

Paul, J. (2011). Impact Evaluation in Practice Handbook. Practitioners. Washington D.C. World Bank.

Shahidur, Khandker, Gayatri (2010). Handbook on Impact, Quantitative Methods, and Practice.

Ty M. Lawson (2012). The Impact of School Feeding Programs on Educational and Agricultural Development Goals: A Systematic Literature Review, Masters' Thesis, Department of Agricultural Food and Resource Economics, Michigan State University.

WB, (2016) Impact Evaluation in Practice. 2nd edition.

WFP (2008). Standardized School Feeding Survey: 2007 Country Status Report, World Food Programme, Ethiopia.

WFP (2009). CHILD Based Food for Education. W. F. Programme. Addis Ababa.

Appendices

Appendix 1: T-test

```
. ttest agehead,by( SFP)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
T=0:cont	122	43.41803	.7490083	8.273067	41.93517	44.90089
T=1:trea	103	41.8835	.6563983	6.661715	40.58153	43.18546
combined	225	42.71556	.5066971	7.600457	41.71705	43.71406
diff		1.534538	1.014112		-.4639304	3.533006

```
    diff = mean(T=0:cont) - mean(T=1:trea)                        t =   1.5132
Ho: diff = 0                                     degrees of freedom =      223

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9342         Pr(|T| > |t|) = 0.1316          Pr(T > t) = 0.0658
```

Appendix 2: Probit Model to predict the propensity

```
. psmatch2 SFP agehead eduheadyear famsize famlysupport HYSCS Tutorial Latecom ,outcome( AVSCORE)

Probit regression                               Number of obs   =        225
                                                LR chi2(7)      =      43.29
                                                Prob > chi2     =     0.0000
Log likelihood = -133.50988                     Pseudo R2       =     0.1395
```

SFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
agehead	-.0096126	.0123121	-0.78	0.435	-.0337439	.0145187
eduheadyear	-.1096481	.0219808	-4.99	0.000	-.1527298	-.0665665
famsize	-.0664916	.0641193	-1.04	0.300	-.1921632	.05918
famlysupport	-.5392037	.2408677	-2.24	0.025	-1.011296	-.0671117
HYSCS	.0134136	.0466234	0.29	0.774	-.0779665	.1047937
Tutorial	.160145	.1936262	0.83	0.408	-.2193553	.5396454
Latecom	.0001628	.1937084	0.00	0.999	-.3794986	.3798243
_cons	1.051195	1.007056	1.04	0.297	-.9225992	3.024989

```
There are observations with identical propensity score values.
The sort order of the data could affect your results.
Make sure that the sort order is random before calling psmatch2.
```

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
AVSCORE	Unmatched	65.7641748	63.1720492	2.59212558	1.14979501	2.25
	ATT	65.7641748	62.036699	3.72747573	1.8208495	2.05

```
Note: S.E. does not take into account that the propensity score is estimated.
```

psmatch2: Treatment assignment	psmatch2: Common support On suppor	Total
Untreated	122	122
Treated	103	103
Total	225	225

Appendix 3: pstest for unmatched and matched covariates mean bias and graph

```
. pstest, both graph
```

Variable	Unmatched / Matched	Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|	V(T)/ V(C)
agehead	U	41.883	43.418	-20.4		-1.51	0.132	0.65*
	M	41.883	42.282	-5.3	74.1	-0.40	0.691	0.75
eduheadyear	U	2.2913	5.377	-75.2		-5.54	0.000	0.51*
	M	2.2913	2.4272	-3.3	95.6	-0.28	0.782	0.85
famsize	U	4.7379	5.2541	-33.0		-2.47	0.014	1.08
	M	4.7379	4.7961	-3.7	88.7	-0.27	0.786	1.18
famlysupport	U	.23301	.46721	-50.4		-3.74	0.000	.
	M	.23301	.21359	4.2	91.7	0.33	0.739	.
HYSCS	U	7.9029	8.7049	-33.6		-2.48	0.014	0.61*
	M	7.9029	8.0194	-4.9	85.5	-0.38	0.708	0.77
Tutorial	U	.46602	.39344	14.6		1.09	0.275	.
	M	.46602	.48544	-3.9	73.2	-0.28	0.782	.
Latecom	U	3.7379	3.6885	10.2		0.76	0.446	1.01
	M	3.7379	3.7379	0.0	100.0	0.00	1.000	1.09

* if variance ratio outside [0.68; 1.48] for U and [0.68; 1.48] for M

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.140	43.29	0.000	33.9	33.0	92.9*	0.62	60
Matched	0.003	0.75	0.998	3.6	3.9	12.0	0.98	0

* if B>25%, R outside [0.5; 2]

```
. pscore SFP agehead eduheadyear famsize famlysupport HYSCS Tutorial Latecom    , pscore(ps08) blockid(blockf2) comsup level(0
> .001)
```

Appendix 4:

```
**************************************************
Algorithm to estimate the propensity score
**************************************************


The treatment is SFP
```

SFP beneficiary dummy ariable 1=yes,0=no	Freq.	Percent	Cum.
T=0:control	122	54.22	54.22
T=1:treatment	103	45.78	100.00
Total	225	100.00	

```
Estimation of the propensity score

Iteration 0:   log likelihood = -155.15494
Iteration 1:   log likelihood = -133.89849
Iteration 2:   log likelihood = -133.51035
Iteration 3:   log likelihood = -133.50988
Iteration 4:   log likelihood = -133.50988

Probit regression                                 Number of obs   =        225
                                                  LR chi2(7)      =      43.29
                                                  Prob > chi2     =     0.0000
Log likelihood = -133.50988                       Pseudo R2       =     0.1395
```

SFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
agehead	-.0096126	.0123121	-0.78	0.435	-.0337439	.0145187
eduheadyear	-.1096482	.0219808	-4.99	0.000	-.1527298	-.0665665
famsize	-.0664916	.0641193	-1.04	0.300	-.1921632	.05918
famlysupport	-.5392037	.2408677	-2.24	0.025	-1.011296	-.0671117
HYSCS	.0134136	.0466234	0.29	0.774	-.0779665	.1047937
Tutorial	.1601451	.1936262	0.83	0.408	-.2193553	.5396454
Latecom	.0001628	.1937084	0.00	0.999	-.3794986	.3798243
_cons	1.051195	1.007056	1.04	0.297	-.9225991	3.024989

Appendix 5: Balancing Propensity

```
Note: the common support option has been selected
The region of common support is [.10759133, .77647996]
```

Description of the estimated propensity score
in region of common support

Estimated propensity score

	Percentiles	Smallest		
1%	.1139885	.1075913		
5%	.1604286	.1089491		
10%	.179269	.1139885	Obs	214
25%	.3337321	.1184325	Sum of Wgt.	214
50%	.4732521		Mean	.477896
		Largest	Std. Dev.	.1962387
75%	.6610037	.7666075		
90%	.7290496	.76954	Variance	.0385096
95%	.7472388	.7753426	Skewness	-.1989564
99%	.76954	.77648	Kurtosis	1.83039

```
*******************************************************
Step 1: Identification of the optimal number of blocks
Use option detail if you want more detailed output
*******************************************************

The final number of blocks is 4

This number of blocks ensures that the mean propensity score
is not different for treated and controls in each blocks


***********************************************************
Step 2: Test of balancing property of the propensity score
Use option detail if you want more detailed output
***********************************************************

The balancing property is satisfied

This table shows the inferior bound, the number of treated
and the number of controls for each block
```

Inferior of block of pscore	SFP beneficiary dummy ariable 1=yes,0=no T=0:contr	T=1:treat	Total
.1075913	19	6	25
.2	34	14	48
.4	35	29	64
.6	23	54	77
Total	111	103	214

```
Note: the common support option has been selected

*****************************************
End of the algorithm to estimate the pscore
*****************************************
```