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# Impact of Major Vegetable Production on Youth's Income the Cause of Gidda Ayana District, East Wollega Zone, Oromia Region Ethiopia

**Waktole Bayisa Debelo, Abayineh Amare, Birki Gurmessa**

Jimma Agricultural School, Jimma University, Jimma, Ethiopia

**Email address:**
waktolebayisa@yahoo.com (W. B. Debelo)
*Corresponding author

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**Abstract:** Vegetable production is an agricultural activity that demands intensive labor and plays dominant role in human nutrition, health improvement, income generation and poverty reduction. The general objective of this study was to analyze the impact of major vegetable production on rural youth income in the study area. Three stage sampling procedures were used in this study. The primary data were collected through focus group discussion and key informant interview. Secondary data were collected from review of related literatures and documents. Propensity scoring match (PSM) was used for analyzing quantitative data. Eight explanatory variables were hypothesized for this study. Accordingly five of them have positively impact on major vegetable production. Based on this age, access to irrigation, access to input and land size were positive affect on youth engagement in vegetable production while, sex of youth was negative impact. The result of PSM analysis indicated that participation in major vegetable production has increased annual youth's farm income by 2812.20 ETB for participant youth than non-participant youth which is significant at 1% significant level. The sensitivity analysis result showed that the impact results estimated by this study were unobserved selection bias. It was concluded that major vegetable production has positive and significant impact on youth's annual income. So to extend their source of income, it is best for youth to find the way with woreda agricultural office to engage in major vegetable production as regular job. Therefore looking collective action should be advisable to improve and sustain the positive impact of major vegetable production by reducing constraints that face youth farmers regarding on major vegetable farming in the area.

**Keywords:** Gidda Ayana, Impact, Major Vegetable, Youth

## 1. Introduction

### *1.1. Back Ground of the Study*

Globally, the number of youth living in urban areas has increased greatly in recent time owing to the effects of rural - urban migration and natural population increase. However, this large proportion of youth is absorbed in the informal sector due to limited opportunities in the formal industry. Youth engaged in the production of major vegetables often earn higher net farm incomes than farmers who are engaged in the production of cereal crops alone. Studies from developing countries frequently show higher average net farm incomes per household member among producers. Production of major vegetable products offers opportunities for poverty alleviation by creating employment opportunities for youth, because it is usually more labour intensive than the production of staple crops. Vegetable cultivation requires more labour than the traditional cropping systems with rice [8]. Diversifying and increasing horticultural production that include tomato, potato and cabbage can help to overcome malnutrition and poverty by augmenting the participation of youth in major vegetable production and consumption as well as by creating and also create new market opportunities for rural and urban youth. Vegetable crops are also important for food security in times of drought, famine and food shortage.

They provide a source of income for the youth; create employment opportunity and contribution to the national economy as export commodities.

The current investment policy in the country are favorable for expansion and diversification of major vegetable crops both in the production and marketing sectors for export and foreign exchange earnings. Public research on horticultural technologies such as vegetable value chain, vertical vegetable farming and homegaurden improved vegetable seed production negligible and major public policies and attention of extension agents were mainly focused on staple crop production so far [10]. The Government emphasized the priority given to agricultural development through its policy document entitled Agricultural Development Led Industrialization (ADLI). This policy focuses on the development of agriculture both as a source of production for direct consumption and of raw materials for industrial processing, on the one hand, and as a major source of consumer products coming out from the industrial sector, on the other.

Public research on horticulture includes papaya, mango, potato, onion and tomato and on horticultural technologies is negligible and major public policies and attention of extension agents were mainly focused on staple crop productions which include maize, sorghum, wheat and barley so far [10]. However, based on growing demand for vegetables especially in the major cities, the major vegetable production is gaining importance in the country and intensification is slowly starting to take place [11].

Generally, agriculture is the main source of livelihood to most developing countries including Ethiopia. The contribution of the youth to agriculture is critical because they are energetic, innovative and dynamic. The decision to start farming and use the available farming resources is due to internal or external motivations. Internal motivations involve interests, perception and willingness to participate in agriculture. Some of the youth farmers were afraid to attempt and risk as well as fear of the perception of others and social inclusion [9].

### *1.2. Statement of the Problem*

Gidda Ayana District produces a wide range of major vegetables including tomatoes, cabbage and potatoes. This major vegetable plays a central role towards meeting food, nutrition security, and source of income and means of economic improvement for the youth in the study area [6]. It is important as a source of employment and increasing foreign currency and it's the most important source of micronutrients and are essential for a balanced and healthy diet in the study area and it is important for food security in times of drought, famine and food shortage. They provide a source of income for the farmers/Youth; create employment opportunity and contribution to the national economy as export commodities.

Essential farming resources such as land, water, finances, farm inputs and labour were necessary for youth to participate in urban vegetable production. This study was excluding rural youth participation in rural major vegetable production [14].

Factors hindering youth participation in vegetable production by using descriptive statics and impact of major vegetable for improvement of their income was not seen in previous study [13]. The previous study also focused on benefit of major vegetable production on urban vegetable farming and impact of major vegetable on rural youth income is left aside. Therefore, the aim of this research was to fill the mentioned research gaps on youth participation in major vegetable production taking the case of Gidda Ayana District, East wollega Zone.

### *1.3. Objectives of the Study*

#### *1.3.1. General Objective*

The general objective of this study was to analyze the impact of major vegetable production on rural youth income in the study area.

#### *1.3.2. Specific Objectives*

1. To assess status of major vegetable Production in the Study area
2. To analyze the impact of major vegetable production on rural youth income in the study area.

### *1.4. Research Questions of the Study*

1. What is the Status of major vegetable production in the study area?
2. Does major vegetable production provide change on youth's income in the study area?

## 2. Research Methodology

### *2.1. Description of Study Area*

Gidda Ayana is the one of Oromia Regional state weroda which is located in the east Wollega zone of Oromia. It is 433 km far from Addis Ababa and 110 km from Nekemte. Gidda Ayana is bordered on by the south Guto Gidda, on the west by Limu, on the North West by Ebantu, on the North by Benishangul gumuz, on the East by Horo Guduru wollega zone and kiramu weroda. Kolla agro ecology (lowland) is characterized by relatively hotter and drier climate, whereas Weyina Dega (middle land) and Dega agro ecology (highland) are wetter and cooler.

Major vegetables play a central role towards meeting food, nutrition security and a source of income for the farmers in general and for youth in particular in the woreda. The District was participating in a wide range of vegetable farming including tomatoes, onion, cabbage, carrot and potatoes [5]. Major vegetable is one means for economic improvement for the youth in the study area.

### *2.2. Research Design*

The researcher was used Cross sectional research design. Quantitatively, youth participation in major vegetable production was measured to identify determinants of youth,

participation in the activities. Youth's age, sex, marital status, education, access to credit, access to irrigation, land size, livestock size, farm experience, source of labour, input supply, extension contact, distance from nearest market, was gathered qualitatively, through interview, focus group discussion and observation.

*Type and Source of Data*

Both quantitative and qualitative data type were collected from primary and secondary data sources to obtain the necessary information for the purpose of the study. Qualitative data was gathered through key informant interview, focus group discussion and direct observation. Primary data was collected from respondents while, secondary data were reviewed and organized from various documents both published and unpublished materials which are relevant to the study. The primary data that are supposed to be important for the study were collected from the respondents. Farmer's characteristics variables**,** household resource ownership variables and institutional related variables relevant to the study such as age of youth, sex of youth, education status of youth, frequency of youth with extension contact, labor availability in youth, distance of youth from nearest market, access to input supply, access to irrigation, farm land size, access to credit and marital status of youth was collected. Secondary data such as background information of the study area collected from secondary data sources such as from different journal, articles, paper and report of agricultural office of the district.

### *2.3. Methods of Data Collection*

To supplement the primary data, focus group discussion held with selected youth farmers to collect qualitative data. Accordingly, two focus group discussions held at each Kebeles having 6-9 youth that have 3 females and 6 male members. Checklist was prepared to collect information from FGD with general outline of major vegetable production. Key informant interview is other method of qualitative data collection with people who have more knowledge about factors that hinders rural youth participation in vegetable production.

Observation: Observation is the qualitative data collection method that researcher was gather information by directly observing what is performing on the ground concerning youth and major vegetable production by directly visiting the performance of participation of youth and on how much farm size they use for major vegetable farming.

*Methods of data analysis*

This study was used propensity score match (PSM) model to identify the impact of major vegetable production on youth's income.

Impact evaluation is the act of studying whether the changes in well-being are indeed due to the intervention and not to other factors. In other word impact evaluation, identifying what would have happened without the intervention of a specific program or if the intervention had not taken place? Is the key task to assess the impact of the intervention?

Assessing the net impact that attributed to a specific program or intervention is possible only if the counterfactual is correctly determined. This is possible by introducing groups known as comparison or control groups that do not participate in a program but more or less have similar characteristics with participating groups known as treatment groups except exclusion from the program. However, obtaining the control group is difficult and needs a great care for two reasons. First, the treatment groups may be chose purposively based on certain characteristics. If these characteristics are observable, it is possible to find the control groups that have the same characteristics. However, if they are unobservable, the selection bias can removed only by a randomized approach. Second, the control group may be benefited from the spillover effects of the same intervention or from other interventions that have a similar effect. In these cases, it is necessary to correctly account for the differences that could arise from the non-random placement of the program and/or from the voluntary nature of participation in the program (self-selection) to generate unbiased estimates of program.

To generate statistically acceptable matched pairs between participants and non-participants, Propensity Score Matching (PSM) probability model used. The logic behind propensity score methods is that balance on observed covariates through careful matching on a single score. This study use propensity score matching techniques in order to build matching pair for participants that have similar observable characteristics between major vegetable producer and non- producer youth based on p-score in absence of baseline data. The propensity score is define as the probability of receiving treatment based on measured Covariates:

$$E(x) = P\ (D=1 \mid X)$$

Where E(x) is the abbreviation for propensity score, P a probability, D=1 a treatment indicator with values 0 for control and 1 for treatment, the "|" symbol stands for conditional on (predicted), and $X$ is a set of observed covariates. In other words, propensity score expresses how likely a person is to select the treatment condition on a given observed covariates. This score is useful because match participants from treatment condition to non-participants from control condition who have a very similar estimated propensity score. This matching process creates a balance between treated and untreated participants. It also expected to create balance on covariates that used to estimate the propensity score. This balance property is a key aspect of propensity score method because; a balanced pre-test covariate cannot be a confounder anymore, each that cannot bias the treatment effect estimate.

A logit model used to estimate Propensity Scores for each observation. The advantage of this model is that the probabilities are bounded between zero and one. The dependent variable is dichotomous, taking two values, 1 if an individual participates in major vegetable production and 0 otherwise. The covariates used to predict treatment assignment using logistic regression, specified as:-

$$Li = \ln(\frac{pi}{1-pi}) = ln(e^{\beta_0 +} \sum_{j-1}^{n} \beta j^x ji) = zi = \beta o + \sum_{j-1}^{n} \beta j^x ji$$

Where *i l* is a log of the odds ratio in favor of participation in major vegetable production?

$^z i$ participation
*o* intercept
*i* regression coefficient to be estimated
xi explanatory variable (like age, sex, education level etc.)

***Table 1.*** *Description of variables and their expected hypothesis.*

| Respondents | Variable description | Measurement | Expected sign |
|---|---|---|---|
| Age of youth | age of respondent | Continuous | + |
| Marital status | marital status of respondent | Dummy | + |
| Farming experience | Experience of youth | Continuous | + |
| Land size | hectares of land | Continuous | + |
| Distance from the nearest market | Market distance | Continuous | - |
| Access to Credit | Credit | Dummy | + |
| Access to irrigation | source of water | Dummy | + |
| Access to input supply | Input access for youth | Dummy | + |

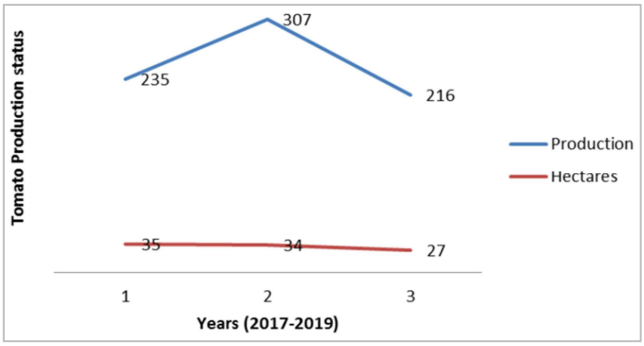
# 3. Results and Discussion

This chapter deals with the analysis of the survey data, status of vegetable production impact of major vegetable production result in the body of this chapter.

### *3.1. Status of Major Vegetable Production in Study Areas*

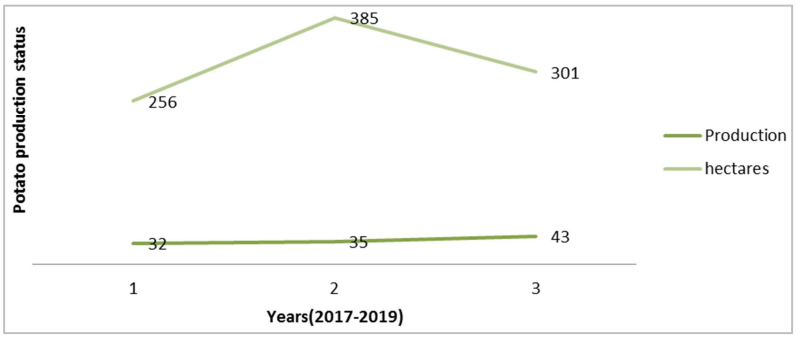
Tomato is one of major vegetable production that is produced in high amount in the study area. Among 101 haters of land used for major vegetable produced in the study area, tomato covers 32 hectares with production of 252.6 tons and takes the second rank by following cabbage. Land size that used for tomato farming and production of tomato in three consecutive years were shown on below figure. Based on this, the hectares of land are decreased from left to right and production is increased because of input accessibility and vegetable infection through this year was controlled [5].

Potato is one of major vegetable that produced by youth in the study area and ranked first in production and land hectares that used for farming. Youth in the study area used potato for both home consumption and source of income generation purposes. As seen from figure 2 below; both hectares and production of potato increased from left to right through three consecutive years. Land hectares covered by potato increased from (32-43 ha) [7]. production also increased from 256 ton to 385 ton with hectors of land increased from 32ha to 35ha and production decreased from 385ton to 301ton but land size increased from 35ha to 43ha at the same years. This show that productivity is not only depends on land size and also depends on other factors that hindering production and productivity of vegetable production, which include accessibility of different agricultural technology like, style of sowing, time of harvesting, use of improved inputs, including herbicide, pesticide and quality seed used and post- harvest technologies [7].




Source: Own work 2019

***Figure 1.*** *Tomato Production Status.*

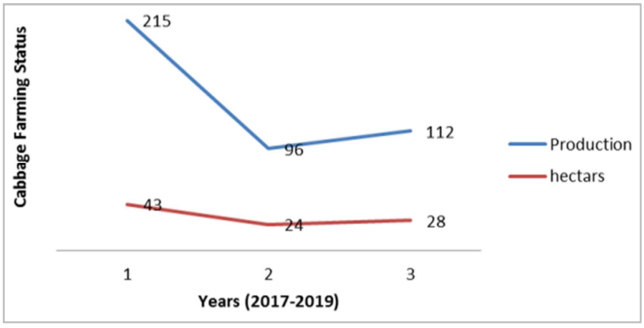



Source: Own work 2019

***Figure 2.*** *Potato Production Status.*

Cabbage is the third major vegetable cultivated by youth in the study kebeles and took hectares of land 43, 24 and 28 respectively with respective years of 2017, 2018 and 2019. From the total 101 hectares of land used for major vegetable

production in the study area; cabbage covered 32ha with respective production of 141.3ton. As expressed in figure 3 below, cabbage production decreased from 215ton to 96ton [7]. Land covered also reduced at the same time and production became increased from 96ton to 112ton from 2018 to 2019 years and hectares of land covered by cabbage also increased in the same years. This show that land size is one of dominant factors that influencing rural youth participation in cabbage farming. Large part of cabbage was cultivated through intercropping with maize and other crops in the study area that is the reason to reduce cabbage production [5].




Source: Own work 2019

***Figure 3.*** *Cabbage Production Status.*

***Table 2.*** *Model Result of the Variables.*

| DEPVARIA | Coef. | Std. Err. | Z | P-value | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| AGE | .2336983 | .0588304 | 3.97*** | 0.000 | .1183928 | .3490038 |
| SEX | -.6799197 | .4068012 | -1.67* | 0.095 | -1.477235 | .1173961 |
| IRRIGATION | 1.906981 | .4134941 | 4.61*** | 0.000 | 1.096547 | 2.717414 |
| LSIZE | 2.878599 | .7722002 | 3.73*** | 0.000 | 1.365114 | 4.392083 |
| MARKETDI | -.0069123 | .0778671 | -0.09 | 0.929 | -.1595289 | .1457043 |
| CREDIT | -.3296677 | .6840225 | -0.48 | 0.630 | -1.670327 | 1.010992 |
| EXTENCON | .2202394 | .2243191 | 0.98 | 0.326 | -.2194178 | .6598967 |
| INPUTSUP | 1.918847 | .6076092 | 3.16*** | 0.002 | .7279551 | 3.109739 |
| _cons | -9.068072 | 1.837459 | -4.94 | 0.000 | -12.66943 | -5.466719 |

Number of observation =205, LR chi2 (8) =109.10, Prob >chi2, Pseudo R2 0.3922, Log likelihood=0.-84540677.
***,*and** (means significant at 1%, 5% and 10% probability level)

***Table 3.*** *Matching algorism.*

| Matching estimators | Balancing test* | Pseudo-R2 after matching | Matched sample size |
|---|---|---|---|
| Nearest Neighbor (NN) | | | |
| Neighbor (1) | 10 | 0.114 | 197 |
| Neighbor (2) | 11 | 0.086 | 197 |
| Neighbor (3) | 9 | 0.093 | 197 |
| Neighbor (4) | 11 | 0.081 | 197 |
| Neighbor (5) | 11 | 0.070 | 197 |
| Caliper Matching (CM) | | | |
| 0.01 | 10 | 0.128 | 180 |
| 0.05 | 10 | 0.114 | 197 |
| 0.1 | 10 | 0.114 | 197 |
| 0.5 | 10 | 0.114 | 197 |
| Kernel Matching (KM) | | | |
| With band width of (0.08) | 11 | 0.061 | 197 |
| With band width of (0.1) | 11 | 0.060 | 197 |
| With band width of (0.25) | 12 | 0.042 | 197 |
| With band width of (0.5) | 11 | 0.066 | 197 |
| Radius Matching | | | |
| With band width of (0.01) | 4 | 0.373 | 197 |
| With band width of (0.1) | 4 | 0.373 | 197 |
| With band width of (0.25) | 4 | 0.373 | 197 |
| With band width of (0.5) | 4 | 0.373 | 197 |

### *3.2. Econometric Result*

A logistic regression model was used to estimate propensity score matching for both participant and non-participant youth in major vegetable production in the study area. As indicated earlier, the dependent variable is binary that indicate youth participation decision in major vegetable production in the study area. The result presented in the table show that the estimated model appears to perform well for the intended matching activity.

As indicated in the table, eight explanatory variables were hypothesized to influence rural youth engagement in vegetable farming. Accordingly five of them have positively impact on major vegetable production. Based on this age, access to irrigation, access to input and land size were positive affect on youth engagement in vegetable production while, sex of youth was negative impact.

#### *3.2.1. Impact of Major Vegetable Production on Youth's Income*

This part presents econometric analysis of impact of major vegetable production on youth's income. It illustrates the estimation of propensity scores, defining common support region, choosing matching algorism, testing matching quality, calculating average treatment effect on treated, propensity score match quality test and sensitivity analysis.

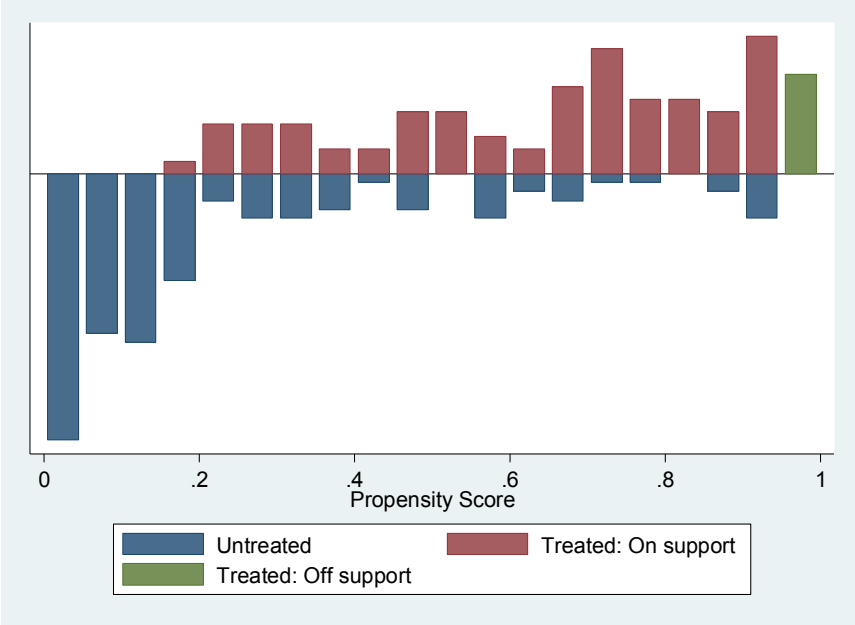
#### *3.2.2. Matching Participant with Non-participant Youth in Major Vegetable Production*

Following identification of common support region, different matching estimators (algorisms) were tried to match major vegetable producer with non-producer youth in common support region. The final choice of matching algorism was guided by three criteria namely equal mean test (balancing test), pseudo R2 and size of matched sample [1]. Matching algorism which balances all explanatory variables of groups (result in insignificant mean differences between participant in major vegetable farming and non-participants), bear low pseudo R2 value and results in large sample size is preferable [4]. Based on those criteria, kernel with bandwidth

of 0.25 was found to be best estimator for this study. Therefore, impact analysis procedure was followed and discussed by using kernel with bandwidth of 0.25.

### *3.2.3. Verifying the Common Support Condition and Propensity Score Distributions*

Figure 4 below shows the distribution of propensity score and common support region. The bottom halves of the histogram show the propensity score distribution of non-participant youth and the upper halves shows the propensity score distribution of participant youth [2]. The blue colored (untreated of support) and the red colored (treated on support) indicates the observations of non-participant youth and participant youth in major vegetable production that have a suitable comparison respectively, whereas the green colored (treated off support) indicates the observations in the participant youth that do not have a suitable comparison.




Source: own compilation, 2020

***Figure 4.*** *Propensity score distribution and common support region for propensity score.*

*Propensity score distributions*

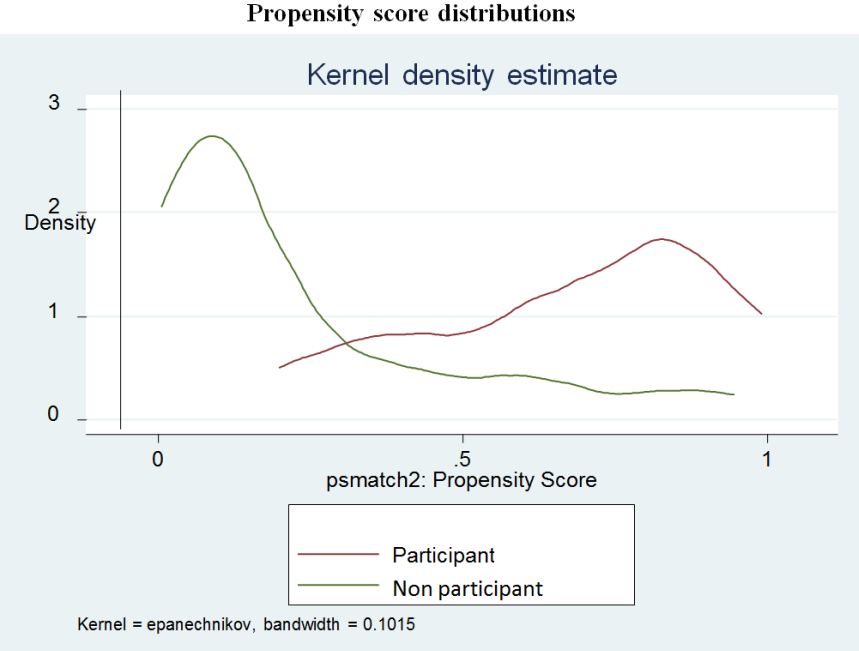



***Figure 5.*** *Kernel density estimate graph.*

### *3.2.4. Distribution of Estimated Propensity Scores*

The propensity scores vary between 0.0056201 - 0.9468806 for non- participant with mean score of 0.2338143. Whereas the score varies between 0.1991934 - 0.9916501 for participants with mean score of 0.6699092. The common support then lies between 0.0056201-0.9916501. This means that youth whose propensity score less than minimum (0.0056201) and larger than maximum (0.9916501) are not considered for matching. Based on this procedure, 8 of youth were discarded from the study in effect assessment procedure.

***Table 4.*** *Propensity score distribution.*

| Group | Obs | Mean | Std.Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| Total youth | 205 | 0.4146341 | 0.3271614 | 0.0056201 | 0.9916501 |
| Treatment youth | 85 | 0.6699092 | 0.2370703 | 0.1991934 | 0.9916501 |
| Control youth | 120 | 0.2338143 | 0.2535712 | 0.0056201 | 0.9468806 |

***Table 5.*** *Propensity Score Quality Test.*

| Sample | Ps $R^2$ | LR $chi^2$ | p>$chi^2$ | Mean Bias | Med Bias | B | R | %Var |
|---|---|---|---|---|---|---|---|---|
| Unmatched | 0.378 | 105.14 | 0.000 | 60.2 | 56.6 | 169.7* | 0.65 | 25 |
| Matched | 0.042 | 8.92 | 0.836 | 11.6 | 8.1 | 48.5* | 2.93* | 13 |

### *3.2.5. Testing the Balance of Propensity Score and Covariates*

As indicated earlier, the main purpose of the propensity score estimation is not to obtain a precise prediction of selection into treatment, but rather to balance the distributions of relevant variables in both groups. The balancing powers of the estimations determine by considering different test methods such as the reduction in the mean standardized bias between the matched and unmatched households, equality of means using t-test significance for the variables used (Table 6). Accordingly, the mean standardized bias before and after matching, shown in the fifth columns of Table 6 below. In the present matching models, the standardized difference in X (a set of observable covariates) before matching is in the range of 2.3% and 50% in absolute value. After matching, the remaining standardized difference of X for almost all covariates lies between 0.1% and 17.5% in absolute value, which below the critical level of 20% suggested by [12].

***Table 6.*** *Propensity score and covariate balance.*

| Variables | Sample | Mean | | stand %redact | | t-test | |
|---|---|---|---|---|---|---|---|
| | | Treated | Control | %bias | Bias | t-value | p>t |
| p-score | Unmatched | .66991 | 0.23381 | 177.7 | | 12.46 | 0.000 |
| | Matched | .63839 | .60614 | 13.1 | 92.6 | 0.82 | 0.416 |
| AGE | Unmatched | 24.047 | 22.342 | 50.0 | | 3.53 | 0.001 |
| | Matched | 23.935 | 23.839 | 2.8 | 94.4 | 0.17 | 0.869 |
| SEX | Unmatched | .30588 | 43333 | 26.5 | | -1.86 | 0.065 |
| | Matched | .32468 | .28162 | 9.0 | 66.2 | 0.58 | 0.564 |
| MARITALS | Unmatched | .82353 | 0.38333 | 100.3 | | 6.93 | 0.000 |
| | Matched | .80519 | .81763 | -2.8 | 97.2 | -0.20 | 0.845 |
| EDUCATIO | Unmatched | 4.1294 | 2.6833 | 72.0 | | 5.30 | 0.000 |
| | Matched | 3.8182 | 3.2623 | 27.7 | 61.6 | 1.67 | 0.096 |
| IRRIGATI | Unmatched | .61176 | .25 | 78.1 | | 5.56 | 0.000 |
| | Matched | .57143 | .56061 | 2.3 | 97.0 | 0.13 | 0.893 |
| LSIZE | Unmatched | .61135 | .43106 | 60.4 | | 4.29 | 0.000 |
| | Matched | .62605 | .64784 | -7.3 | 87.9 | -0.45 | 0.653 |
| FARMEXPE | Unmatched | 3.8706 | 2.4833 | 85.0 | | 6.20 | 0.000 |
| | Matched | 3.6104 | 3.3249 | 17.5 | 79.4 | 1.10 | 0.272 |
| MARKETDI | Unmatched | 6.3482 | 6.275 | 2.8 | | 0.20 | 0.042 |
| | Matched | 6.3195 | 6.2171 | 3.9 | -39.8 | 0.25 | 0.806 |
| CREDIT | Unmatched | .81176 | .9 | -25.2 | | -1.82 | 0.071 |
| | Matched | .85714 | 0. 89639 | -11.2 | 55.5 | -0.74 | 0.462 |
| EXTENCON | Unmatched | .94118 | .94167 | -0.1 | | -0.00 | 0.017 |
| | Matched | .93506 | 1.001 | -7.3 | -13.355 | -0.43 | 0.671 |
| INPUTSUP | Unmatched | .95294 | 0.70833 | 68.7 | | 4.60 | 0.000 |
| | Matched | .94805 | .95697 | -2.5 | 96.4 | -0.26 | 0.796 |
| LABOR | Unmatched | .37647 | 0.18333 | 43.8 | | 3.15 | 0.002 |
| | Matched | .38961 | 0.50897 | .-27.1 | 38.2 | -1.49 | 0.138 |
| LIVESTOC | Unmatched | 2.0353 | 1.6333 | 52.7 | | 3.71 | 0.000 |
| | Matched | 2.0649 | 2.2721 | -27.2 | 48.5 | -1.66 | 0.100 |

Source: own compilation, 2020

### *3.2.6. Propensity Score Matching Quality Test*

The chi-square test result shows that the covariates in the unmatched and matched groups have been balanced. The result is important to compared observed outcomes for participant with those of non-participant in major vegetable production have shared a common support region. Kernel matching algorithm based on a band width of (0.25) was selected for the study. There is substantial overlap in the distribution of the propensity scores of both participant and non-participant groups. The low pseudo-R2, low mean standardized bias, high total bias reduction, and the insignificant p-values of the likelihood ratio test after matching suggest that specification of the propensity score is fairly successful.

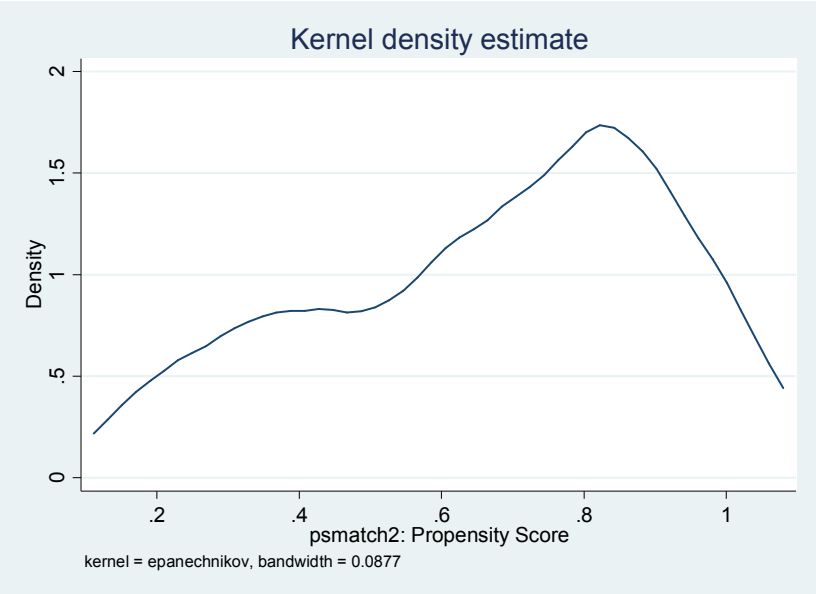



***Figure 1.*** *Kernel density of estimate treated group.*

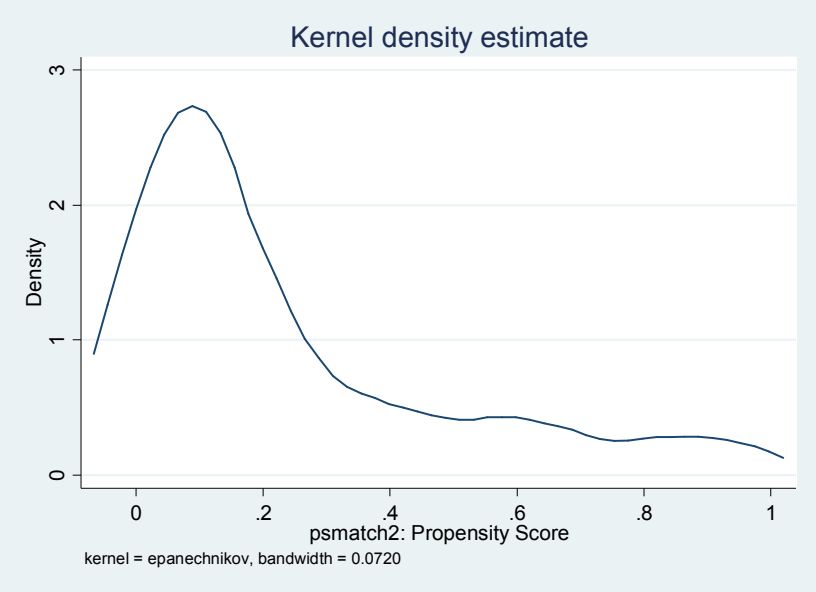



***Figure 2.*** *Kernel density estimate of control.*

***Table 7.*** *Treatment effect.*

| Outcome variable | Sample | Treated | Controls | Difference | S.E. | T -stat |
|---|---|---|---|---|---|---|
| INCOME | Unmatched | 9277.76471 | 5918.34167 | 3359.42304 | 561.038723 | 5.99 |
| | ATT | 8586.62338 | 5774.42299 | 2812.20039 | 698.672741 | 4.03*** |

Note: *** = significance level at 1% and S.E is calculated using bootstrap with 100 repetitions
Source: own compilation, 2020

### *3.2.7. Average Treatment Effect on the Treated (ATT)*

As one can see from the below Table, all the results of the matching estimation techniques are statistically significant at 1% percent probability level of significance. Hence, the ATT result reveals that youth practicing in major vegetable production were significantly different in their welfare based on income indicator. A positive value of average treatment effect on the treated (ATT) also indicates that the annual income of youth have been improved as a result of participation in major vegetable production in the study area. By controlling other variables, it has been found that the annual income of participant youth has increased households by 2812.20 ethio birr. That means, the program has increased the annual income of the participating youth by more about 28.12% from those not participate.

This is obvious that the annual income of youth participant is fairly higher than those of non-participant in all propensity score matching methods. Therefore, the research hypothesis which says participation in major vegetable production increases annual income youth is accepted at 1% level of significance. This is in line with some impact studies on adoption of adoption and participation on improved technology has found positive significant impacts on the productivity and income of the household [3]. It can also be proved that agriculture can increase the income of the rural poor and provide bigger opportunity.

***Table 1.*** *Result of sensitivity analysis using Rosenbaum bounding approach.*

| Gamma | sig+ | sig- | t-hat+ | t-hat- | CI+ | CI- |
|---|---|---|---|---|---|---|
| 1 | .000815 | .000815 | 1791.46 | 1791.46 | 495.747 | 4102.14 |
| 1.05 | .001511 | .000423 | 1619.92 | 2025.58 | 392.273 | 4268.24 |
| 1.1 | .00263 | .000218 | 1463.12 | 2321.23 | 313.831 | 4421.35 |
| 1.15 | .004332 | .000111 | 1326.52 | 2685.52 | 253.567 | 4577.82 |
| 1.2 | .006799 | .000057 | 1192.89 | 2939.31 | 196.537 | 4682.33 |
| 1.25 | .010229 | .000029 | 1093.81 | 3177.43 | 131.19 | 4784.36 |
| 1.3 | .014825 | .000015 | 994.178 | 3310.29 | 75.7885 | 4893.79 |
| 1.35 | .020783 | 7.3e-06 | 908.163 | 3427.16 | 30.4224 | 4970 |
| 1.4 | .028286 | 3.7e-06 | 811.004 | 3510.98 | -20.4022 | 5088.99 |
| 1.45 | .037492 | 1.8e-06 | 746.117 | 3645.6 | -66.2142 | 5183.9 |
| 1.5 | .048525 | 9.1e-07 | 664.729 | 3740.3 | -105.112 | 5246.05 |
| 1.55 | .061473 | 4.5e-07 | 615.773 | 3854.51 | -168.429 | 5308.78 |
| 1.6 | .076385 | 2.3e-07 | 585.127 | 3911.27 | -230.498 | 5383.16 |
| 1.65 | .093263 | 1.1e-07 | 547.718 | 4013.78 | -274.684 | 5451.35 |
| 1.7 | .112071 | 5.5e-08 | 490.978 | 4120.38 | -307.889 | 5494.96 |
| 1.75 | .132734 | 2.7e-08 | 441.256 | 4234.66 | -347.774 | 5547.77 |
| 1.8 | .155141 | 1.3e-08 | 374.943 | 4278.72 | -382.509 | 5629.59 |
| 1.85 | .179151 | 6.6e-09 | 332.116 | 4370.35 | -421.593 | 5673.85 |
| 1.9 | .204599 | 3.3e-09 | 297.129 | 4455.69 | -459.627 | 5763.27 |
| 1.95 | .2313 | 1.6e-09 | 262.283 | 4537.88 | -480.815 | 5826.06 |
| 2 | .259057 | 7.8e-10 | 235.054 | 4620.7 | -522.925 | 5907.7 |
| 2.05 | .287665 | 3.8e-10 | 202.198 | 4675.08 | -549.918 | 5944.4 |
| 2.1 | .316916 | 1.9e-10 | 176.686 | 4714.62 | -586.218 | 6006.88 |
| 2.15 | .346606 | 9.2e-11 | 131.529 | 4772.7 | -612.556 | 6081.42 |
| 2.2 | .376535 | 4.5e-11 | 98.0141 | 4840.04 | -645.947 | 6159.07 |
| 2.25 | .406513 | 2.2e-11 | 76.23 | 4888.96 | -665.839 | 6204.66 |
| 2.3 | .436361 | 1.1e-11 | 48.1999 | 4917.36 | -686.65 | 6283.05 |
| 2.35 | .465917 | 5.3e-12 | 30.4224 | 4970 | -718.052 | 6333.26 |
| 2.4 | .495032 | 2.6e-12 | 6.99725 | 5029.64 | -759.122 | 6395.31 |
| 2.45 | .523572 | 1.2e-12 | -20.4023 | 5088.99 | -781.41 | 6419.96 |
| 2.5 | .551422 | 6.1e-13 | -46.5958 | 5128.22 | -814.903 | 6471.44 |

* Gamma - long odds of differential assignment due to unobserved factors
Sig+ - upper bound significance level
Sig- - lower bound significance level
T-hat+ - upper bound Hodges-Lehmann point estimate
t-hat- - lower bound Hodges-Lehmann point estimate
CI+ - upper bound confidence interval (a=.95)
CI- - lower bound confidence interval (a=.95)

### *3.2.8. Sensitivity Analysis*

Deciding which variables should be included in a statistical model is one of the unsolved and probably most debatable issues in observational study. Relevant but omitted variables but which is relevant to the matching major vegetable producer with non-producer youth cause bias in outcome of intervention. The standard response to this knowledge has been to include additional control variables under the belief that the inclusion of every additional variable serves to reduce the potential threat from omitted variable bias. However, reality is more complicated, and the control variable strategy does not protect from omitted variable bias [12]. To reduce the above problem, sensitivity analysis has got a great attention on this day. Recently, it becomes an

increasingly important topic in the applied evaluation literatures [1]. In order to check for unobservable biases, using Rosenbaum Bounding approach sensitivity analysis was performed on the computed outcome variables with respect to deviation from the conditional independence assumption [1]. The basic question to be answered here is whether the finding about treatment effects may be affected by unobserved factors (hidden bias) or not.

Based on this, sensitivity analysis was conducted for outcome variable (farm income in table 8) presents the critical level of eγ=1 (first row), over which the causal inference of significant major vegetable producer outcomes (effect) must be questioned. The first column of the table shows those outcome variables which bear statistical differences between major vegetable producer and non-producer in effect estimate. The rest of the values which correspond to each row of the significant outcome variables are p-critical values (or the upper bound of Wilcox on significance level -Sig+) at different critical value of eγ [12].

## 4. Conclusion

In youth dominated country such as Ethiopia, Major vegetable are used as employment opportunity for unemployed young people. Education level of youth influence participation in major vegetable production positively; this implies that, educated youth may be more aware of the benefits of modern technologies and may have a greater ability to learn new information hence easily participate vegetable farming and as well as new technologies. The result shows that marital status has positive and significant influence participation in major vegetable production. This indicates that, the household with more family size will contribute to the higher agricultural production with massive and cheap labor and hence reducing the cost of production than with the families hire in labor.

Small scale irrigation accessibility of the youth exhibits a hill shaped relationship with the probability of participation in major vegetable production and also land size enables the farm youth to engage in major vegetable farming due to the benefit they derive from major vegetable production participation too.

From the above impact analysis, the ATT estimation result of the treated group shows 8586.62338 and 5774.42299 Birr difference treated and control group respectively. Finally, the average income difference of the treated with the control group shows a 2812.20039 Ethio Birr.

## Lists of Acronyms

| | |
|---|---|
| CIA | conditional independency assumption |
| ATT | Average Treatment on Treated |
| ADLI | Agricultural Development and Lead Industrialization |
| MoFED | Ministry of Finance and Economic Development |
| UNDP | United Nation development Programme |
| FDG | Focus group discussion |
| KM | Kernel Matching |
| ETB | Ethiopian Birr |
| PSM | Propensity Score Matching |

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