



# Malaysian Business Management Journal (MBMJ)

DOI: <http://doi.org/10.26480/mbmj.01.2022.01.06>



**RESEARCH ARTICLE**

## PRODUCERS' PARTICIPATION DECISION IN TOMATO AND ONION MARKETING WITH LEVEL OF PARTICIPATION IN EJERSA LAFO DISTRICT OF WEST SHEWA ZONE, OROMIA NATIONAL REGIONAL STATE, ETHIOPIA

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**ARTICLE DETAILS**

**Article History:**

Received 20 November 2021  
 Accepted 23 December 2021  
 Available online 28 December 2021

**ABSTRACT**

Vegetable plays a substantial role in the life and livelihood of most Ethiopians. Thus, the study was aimed to investigate tomato and onion producers' market participation with level of participation in Ejersa Lafo district of West Shewa Zone, Oromia National Regional State, Ethiopia. The data was obtained from 145 randomly selected sample farm households. The collected data were analyzed using inferential statistics and econometric model Heckman two step procedure. Out of the total interviewed households 61(42.07%) of them were market participant while the remaining 84(57.93%) were non-market participant. Heckman two-step procedure was used to analyse the determinants of participation in tomato and onion markets and volume of sales during the study period. First heckman step shows that education level, family size and access to credit services significantly and positively affected market participation decision, while age of household head and total cultivated land had significant and negative effect on market participation decision. Further results from second heckman step displays sex of household head, family size, frequency of ploughing and extension contact significantly and positively affected level of participation in the markets, however age and number of livestock owned had significant and negative effect. To enable smallholder's participation in tomato and onion marketing, government and the concerned body intervention is needed. This study may be valuable input for smallholder farmers, policymakers and other stakeholders that will probably enhance market participation and sales volume in the study area.

**KEYWORDS**

Market Participation, Heckman two step procedure, Probit, OLS, Ethiopia


**1. INTRODUCTION**

Agriculture is the backbone of Ethiopian economy and it includes crops, livestock, forestry, fisheries and apiculture (FAOSTAT, 2019). It accounts for over 35.8% to the country's GDP and 79% of the national export earnings were obtained from this sector (CIA, 2019). This indicates that the performance of the entire economy of the country largely depends on the performance of agricultural growth. Ethiopia has a variety of vegetable and root crops grown in different agro ecological zones produced through commercial as well as smallholder farmers both as a source of income and food (Hunde, 2017). Hence, on average more than 54,250,718.49 quintals of vegetables and root crops are produced by private peasant holdings (CSA, 2018; CSA, 2019).

Vegetables are produced in larger volume compared with other crops because they are the principal staple crops. Out of the total vegetable crop area; Lettuce, Head Cabbage, Ethiopian Cabbage, Tomatoes, Green peppers, Red peppers, and Swiss chard took up 0.10%, 2.15%, 20.15%, 1.65%, 4.22%, 71.58%, and 0.16% of the vegetable crop area, respectively. Concerning root crops; Beetroot, Carrot, Onion, Potatoes, Yam/Boye', Garlic, Taro/Godere, and Sweet potatoes also took up 1.67%, 1.11%, 11.46%, 32.09%, 1.79%, 9.47%, 24.42%, and 18% of the root crops production area, respectively (CSA, 2018; CSA, 2019).

In Ethiopia, vegetable production is significant economic activity which ranging from nursery smallholder farming to marketable state and private farmsteads (Rahiel et al., 2018). Though, marketing of vegetable do complex especially owing to its perish-ability, seasonality and bulkiness nature (ELDANRO, 2021). This is also leading to high and fluctuating consumer prices and unfair share of the retailer's price. At same time, the livelihood of many smallholder farmers is becoming dependent on the cash income from commerce of agricultural product like tomato and onion crop. It is also common to see imperfect markets in countries primarily depending on the agricultural commodities (Negasi, 2015). The problem is severe for countries like Ethiopia that obtain a big share of their gross domestic product, employment opportunity, etc from agriculture (Regasa et al., 2020).

Furthermore, the result from the reviewed literatures indicated that, a significant factor which affect positively in one place at certain time may not necessarily be significant in other places, even in the same places after a time. Hence, policy implications drawn from some of the above empirical works may not allow in designing area specific policies to be compatible with its socio-economic as well as agro-ecologic conditions. Consequently, this study was conducted with the objective of producers' participation decision in tomato and onion marketing with its level of participation in the study area.

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2. RESEARCH METHODOLOGY

2.1 Description of the Study Area

The study was conducted in Ejersa Lafo district, which is one of the 22 districts of West Shewa zone. It was bordered on the South by Ilu district of the Southwest Shewa zone, on the Southwest by Dawo district again of the Southwest Shewa zone, on the West by Dendi district, on the North by Jeldu district, on the East by Ejere district. The district was located at the distance of 70 kms away from the capital city of Ethiopia, Finfine to the West direction and 47 kms away from the Ambo; zonal town to the East. The current administration structure of the district was 17 rural and 3 urban *kebeles*. The district had a population of 61,141 and out of these males are 33,604 and females are 27,537 (ELDAO, 2021).

The district has the total coverage area 32,365 hectare. The annual temperature of 9.3-23.8°C and annual rainfall 750-1170 mm. Ejersa Lafo district has a total of 9,819 households. Out of which males are 7,462 and females 2,357. The highland and midland agro-ecological zone was 21% and 79% of the total area of the district, respectively. About 87.6% of the populations are dependent on agriculture. From crops produced in the district *teff* takes the largest portion of production. Out of the all-vegetable production (tomato, onion, potato, cabbage and green pepper) collected in the year 2019/20 in this district was 453,624qts. Currently the production of vegetables increases over time. To cite an example in the 2016/17 production year cover about 403 ha, while in the 2017/18 production year it reached about 509.5 ha. In the 2018/19 production year 621 hectares were covered by vegetables (ELDANRO, 2021).

Livestock are used as source of drought power, food and income source in addition to crop production. It is estimated the district has a total livestock population of 106,461 of which cattle population 74,853 comprises the major share followed by small ruminants with a population of 24,971 (ELDLFRDO, 2021). Having this potential the district is suffering from lack of well-organized systematized market oriented production system which discourages production and productivity of vegetable as required. Generally, all these facts can tell us there were massive potentials for improving the life of the population in the area if market oriented agricultural production system is efficiently and effectively undertaken.

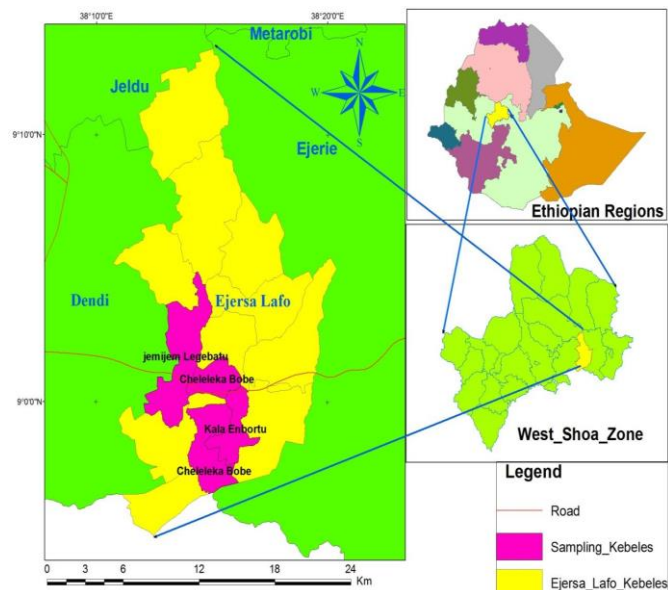


Figure 1: Location of the study area

Source: Sketch from (GIS, 2021)

2.2 Types and Sources of Data

The research was approached using primary and secondary data sources, which have qualitative and quantitative nature.

2.3 Sampling Techniques and Sample Size Determination

Two-stage sampling techniques were employed to get representative sample. In the first stage, three kebeles out of seven potential vegetables producing kebeles were selected randomly from midland agro-ecological zone/area of the district. In the second stage, sample vegetable producers were selected using probability proportional to size (PPS) from each of the three selected kebeles. The sample size was estimated by formula and determined using simple random sampling (SRS) methods to get the total of 145 sample households (Yamane, 1967). The simplified formula to calculate the sample size was:-

$$n = \frac{N}{1+N(e)^2} = \frac{2090}{1+2090(0.08)^2} = 145 \tag{1}$$

Where: n = Sample size, N = Total number of vegetable producers in studied kebeles, e = level of precision which is 8% (since, the producers have homogeneity characteristics) and 1 is for designates probability of the event occurring. Yamane's formula was used because of its homogenous type of population in the study area and known population and 8% of precision level was applied for the purpose of managing all samples in terms of the available resource that the researchers have including cost, time, etc.

The formula used to calculate the number of sample farmers in ith selected kebele was:

$$ni = \frac{Ni*n}{N} \tag{2}$$

Where:

$n_i$  = number of the household heads selected from the  $i^{th}$  kebele

$N_i$  = is the total number of vegetables producing household heads in  $i^{th}$  kebele

n = is the number of sample size

N = is the total number of vegetables producing HH heads in the three selected kebeles

| Table 1: Sample households of the three kebeles |                         |        |       |                        |        |               |
|---|-------------------------|--------|-------|------------------------|--------|---------------|
| Name of Kebeles                                 | Vegetable producing HHs |        |       | Sample household heads |        |               |
|   | Male                    | Female | Total | Male                   | Female | Total samples |
| Chalalaka Bobe                                  | 593                     | 210    | 803   | 41                     | 15     | 56            |
| Jamjam L/ Batu                                  | 645                     | 102    | 747   | 45                     | 7      | 52            |
| Kala Embortu                                    | 380                     | 160    | 540   | 26                     | 11     | 37            |
| Total   | 1,618                   | 472    | 2,090 | 112                    | 33     | 145           |

Source: Own computation based on the district data (2021)

2.4 Methods of Data Collection

The primary data were collected by means of semi-structured questionnaire from sample households, checklist from focus group discussion and key informant. The questionnaire includes policy and institutional factors, socioeconomic factors, demographic characteristics and market factors. Primary data was obtained from farmers, DA's, and district agricultural experts. Secondary data such as: reports of line ministries, journals, books, CSA and internet browsing, national policies, zone and district reports, among others were also used to augment primary data.

2.5 Method of Data Analysis

2.5.1 Descriptive Statistics

Descriptive statistics such as mean, percentages, frequencies, inferential statistics (chi-square and t-test) and standard deviation were applied to describe demographic, socio-economic, farm and institutional characteristics of producers in the study area.

2.5.2 Econometric Analysis

Heckman two step econometric models were used to determine factors affecting farmers' participation decision in vegetables (tomato and onion) markets and the volume of vegetable products supplied and sold to the market. Under a semi-commercial system, where both marketing and home consumption are playing a central role in production decision, all crops produced by a household may not be marketable surplus. Different authors adopted Heckman's two stage model to identify factors that affect producers' participation in output markets and also identify factors that determine the level of output supplied to the market (Bogale and Ayalneh, 2005; Shepherd, 2007; Azam et al., 2012; Rikitu et al., 2019). The Heckman model is useful for handling linear regression when there's a selection mechanism at work i.e. once the result equation involves never-ending variable. However, it usually interested by cases wherever the result equation involves a divided variable. In effect, we would have a probit choice equation and a probit outcome equation (Frederick, 1983). Tobit model has the problem of assumption to address the market participation objectives. It assumes the same set of parameters and

variables to decide both the probability of market participation and the level of participation. Due to this assumption, the same variables in the same way introduce consistency bias in the model. Hence, Heckman two stages are employed in this study to minimize these problems. The model is comprised of two steps; firstly, choice condition is evaluated by utilizing a probit model and also, a result condition is evaluated by using OLS regression. A Probit model predicts the likelihood of whether the individual participates in vegetable market or not:

$$p_r(z_i = 1/\omega_i, \alpha) = \Phi(t(\omega_i, \alpha)) + \tag{3}$$

Where  $Z_i$  is an indicator variable equal to unity for farmers participating in vegetable market,  $\Phi$  is the standard cumulative distribution function,  $\omega_i$  factors affecting decision to participate in vegetable market,  $\alpha$  is the vector of coefficient to be estimated and  $\varepsilon_i$  is normally distributed disturbance term with mean zero and variance  $\delta^2$ . The variable  $Z_i$  takes the estimation of 1 if farm household  $i$  participate in vegetable market and zero otherwise.

$$z_i^* = \alpha\omega_i + u_i \tag{4}$$

Where  $Z_i^*$  is the idle dimension of utility the small scale vegetable farmers get from market participation,  $\sim N(0, 1)$  and,

$$z_i = 1 \text{ if } z_i^* > 0 \tag{5}$$

$$z_i = 0 \text{ if } z_i^* \leq 0 \tag{6}$$

Heckman models incorporate exclusion restrictions to compute an adjustment factor Inverse Mills Ratio (IMR) which included in the second-stage estimation in OLS part of this model. The IMR is figured as:

$$\frac{\varphi(h(\omega_i, \hat{\alpha}))}{\varphi(\omega_i, \hat{\alpha})} \tag{7}$$

Where  $\varphi$  the normal probability function. The second equation is given by:

$$E = (y_i/Z = 1) = f(x_i, \beta) + \lambda \left( \frac{\varphi(h(\omega_i, \hat{\alpha}))}{\varphi(\omega_i, \hat{\alpha})} \right) \tag{8}$$

Where  $E$  is the desire administrator,  $Y$  is the continuous extent of vegetables (tomato and onion) sold,  $x$  is a vector of autonomous factors influencing the amount of vegetable sold, and  $\beta$  is the vector of the comparing coefficients to be estimated. In this way,  $Y_i$  can be explained as follows:

$$y_i^* = \beta x_i + \gamma \lambda + u_i \tag{9}$$

$y_i^*$  - is only observed for those vegetable farmers who participate in the markets

Where  $\sim N(0, \delta_u)$ . ( $Z_i = 1$ ), in which case  $Y_i = Y_i^*$ .

The model would thus be evaluated as follows; in the first step of deciding whether to participate in vegetable market or not. This can be indicated as:

$$p(0,1) = \beta_0 x_0 + \beta_1 x_1 + \dots + \beta_n x_n + e \tag{10}$$

Where 1 denoted participation and 0 non-participation,  $\beta_0$  is a constant  $\beta_1 \dots n$  are parameters to be estimated  $x_i$  are vector of explanatory variables.

In the second step OLS were estimated to test the effect of hypothesized factors on the level of participation measured by the amount of tomato and onion sales in the market (Frederick, 1983). The model is specified as;

$$y = \beta_0 x_0 + \beta_1 x_1 + \dots + \beta_n x_n + e \tag{11}$$

Where  $Y$  denotes the volume of vegetable sold,  $\beta_0$  is a constant,  $\beta_1 \dots n$  are parameters to be estimated  $X_i$  are vector of explanatory variables.

### 3. RESULTS AND DISCUSSION

#### 3.1 Descriptive Statistical Results

Vegetables (tomato and onion) farm efficiency and its market participation is determined by different farmer characteristics. Before discussing results obtained from descriptive and econometric model, it is important to have the overview of sampled households with their participation distribution in the market. Accordingly, the sex frequency distribution percentage of the sampled household was 77.24% male and 22.76% female headed (Figure 2). From this, it was understood that male

frequency distribution percentage is greater than the female. This may due to the fact that females are the one who has responsible for many household domestic activities; they may not accomplish the farming activities on time and efficiently. But, male farmers have practical experiences in the farming operation and would use inputs maximum than female household heads.

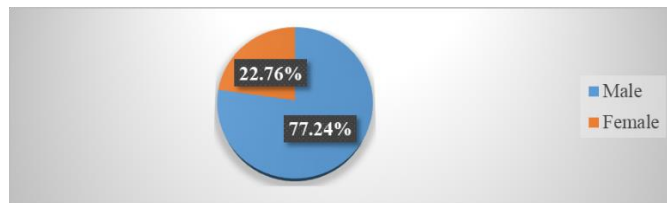


Figure 2: Sex frequency distribution percentage of sampled households  
Source: Own analysis (2021)

As illustrated in table 2 below, out of total interviewed 145 households 61(42.07%) of them were market participant while the remaining 84(57.93%) were non-market participant.

| (n=145) | Market participant |       | Non-market participant |       |
|---------|--------------------|-------|------------------------|-------|
|         | No.                | %     | No.                    | %     |
| Male    | 48                 | 33.10 | 64                     | 44.14 |
| Female  | 13                 | 8.97  | 20                     | 13.79 |
| Total   | 61                 | 42.07 | 84                     | 57.93 |

Source: Own survey result (2021)

#### 3.1.1 Inferential Statistics of Dummy Variables

Table 3 shows that out of the total vegetable producers about 61(42.07%) were vegetables market participant while 84(57.93%) were non-market participants. Results show that 13(21.31%) of the female and 48(78.69%) male respondents were market participant. The results also shows that, 17(32.08%) of market participants and 36(67.92%) non-market participants were involved on off/non-farm activities. Furthermore, results show that 57(42.54%) of vegetables (tomato and onion) market participants and about 77(57.46%) non-participants have fertile land. The  $\chi^2$  test results showed that there is significant difference between market participant and non-participant in terms of involvement in off/non-farm activities at 10 percent probability level. The result also show that, 39(37.14%) of vegetable market participant farm household have access to credit services while 66(62.86%) of them were non-market participant. This variable was statistically significant at 10 percent significance level.

| Variables        |          | Market participant (61) |       | Non-market participant (84) |       | $\chi^2$ value |
|------------------|----------|-------------------------|-------|-----------------------------|-------|----------------|
|                  |          | No.                     | %     | No.                         | %     |                |
| Sex of HH        | Female=0 | 13                      | 21.31 | 20                          | 60.6  | 0.13           |
| Off/non-farm     | Yes      | 17                      | 32.08 | 36                          | 67.92 | 3.42*          |
| Soil fertility   | Yes      | 57                      | 42.54 | 77                          | 57.46 | 0.16           |
| Access to credit | Yes      | 39                      | 37.14 | 66                          | 62.86 | 3.79*          |

Note: \* showed 10% significance level

Source: Own surveyed data (2021)

#### 3.1.2 Inferential Statistics of Continuous Variables

As indicated in Table 4 below, the average age of vegetable market participant sample household head was 39.08 and for non-participants were 35.86 years with a standard deviation of 9.73 and 8.01 respectively. The age of sample household heads between market participant and non-participant is statistically significant at 5 percent significance level. The average educational level in schooling years of the participant farm household head is 5.61; while for non-participant household head is 8.19 with 1 percent significance level. This indicates that, on average the sample farm household heads attended the minimum (first cycle) education.

As presented in the table, the average family size of the participant farm household was 3.92 while that of non-participants is 3, and statistically significant at 1 percent significance level. The average total cultivated land of market participant is 1.85 hectares with a standard deviation of 1.24, while that of non-participant is 1.19 ha with a standard deviation of 0.76. The average total livestock owned by vegetables (tomato and onion)

market participants and non-participants were 10.46 and 8.77 TLU with a standard deviations of 2.61 and 2.10 respectively. There is significant difference between participant and non-participant at 1 percent significance level. The average frequency of ploughing the farm for vegetable production of market participant is 3.66 with a standard deviation of 0.95, whereas the non-market participant is 3.33 with a standard deviation of 1.18.

The result also showed that, the average distance from home to the nearest market of vegetable producers' participant farm household heads were 0.77 walking hour with a standard deviation of 0.33, while for those who were not participating in vegetables market it takes 0.65 with a standard deviation of 0.29. On other hand, the average extension contact of market participant farm household was 5.61 and that of non-participant is 4.76. This implies that market participant farm households have got extension contact than the counterpart i.e there is significant difference between participants and non-participants at 5 percent significance level.

**Table 4: Descriptive statistics of continuous variables**

| Variables                     | Vegetable farmers       |          |                              |          |          |
|-------------------------------|-------------------------|----------|------------------------------|----------|----------|
|                               | Market participant (61) |          | Non-market participants (84) |          |          |
|                               | Mean                    | Std. Dev | Mean                         | Std. Dev | T-test   |
| Age of HH head (years)        | 39.08                   | 9.73     | 35.86                        | 8.01     | -2.19**  |
| Educational level (year)      | 5.61                    | 2.36     | 8.19                         | 2.32     | 6.58***  |
| Family size (number)          | 3.92                    | 1.19     | 3                            | 1.12     | -4.75*** |
| Total cultivated land (ha)    | 1.85                    | 1.24     | 1.19                         | 0.76     | -3.97*** |
| Total livestock owned (TLU)   | 10.46                   | 2.61     | 8.77                         | 2.10     | -4.31*** |
| Frequency of ploughing (no)   | 3.66                    | 0.95     | 3.33                         | 1.18     | -1.77*   |
| Distance to the market (hour) | 0.77                    | 0.33     | 0.65                         | 0.29     | -2.22**  |
| Extension contact (number)    | 5.61                    | 2.06     | 4.76                         | 2.13     | -2.39**  |

Note: \*\*\*, \*\* and \* indicate the level of significance at 1, 5 and 10 percent, respectively.

Source: Own surveyed data (2021)

### 3.2 Econometric Result

#### 3.2.1 Determinants of Market Participation Decision

Heckman two-step selection model was employed to determine the factors influencing sampled households' participation and level of participation in tomato and onion marketing. The variables included in the model were sex of household head, age, educational level, family size, total cultivated land, off/non-farm activities, number of livestock owned, fertility status of the land, frequency of ploughing, frequency of extension contact and access to credit services. The coefficients of selection equation were used for interpretation.

To determine the factors influencing market participation of tomato and onion in Ejersa Lafo district, a probit model was estimated in the first step of the Heckman selection equation. The summary of model result was presented in Table 5 below. Accordingly, age of household head, education level, family size, total cultivated land and access to credit services were found to significantly affect the farmers' decision to participate in the vegetable market. The coefficient of Inverse Mill's ratio (Lambda) in the Heckman two-stage estimation was significant and positive at less than 10 percent probability level, which suggests that the error term in the selection and primary equation are negatively correlated. This indicates that unobserved factors that make participation in vegetable marketing are more likely to be linked with higher scores on the dependent variable.

The chi-square result indicates that the overall goodness of fit (model

adequacy) of the Heckman two-step selection model is statistically significance at a probability of less than 1%. This shows that, jointly the independent variables included in the selection model explain the level of vegetables (tomato and onion) market participation. Moreover, rho is negative which implies that unobservable factors were negatively correlated with dependent variables (Table 5).

Age of household head (AGE): Age of household head had a negative and significant effect on tomato and onion market participation decision. The variable could have been negative because of older households tend to be risk averse than younger household heads which makes them less likely to participate in the market. Older household head may choose to wait for buyers at village level or farm unlike younger household heads who may travel to town to sell their commodity. In addition, when households get older and older, they tend to rent out their land or they shift to the production of lesser labour intensive farming alternatives; since the younger people are more receptive to new ideas. This finding is consistent with the findings who found that besides being risk averse, older farmers are slow in adopting technology which may reduce their production and probability of participation in the market (Regasa et al., 2020).

The educational level of household head: This variable influenced the probability of smallholder farmer's decision to enter in the market positively and significantly. Hence, this enables the household access to more information and new opportunities in various markets for their product. This means that education level of household head is very important in enhancing market participation rate as it enables to acquire the new ideas and modern techniques of agricultural production and therefore increases the market surplus. This result is in line with (Maponya et al., 2016; Rikitu et al., 2019 and Regasa et al., 2020) those who stated that as individual access more education he/she is empowered with the marketing skill and knowledge that will spur individual to participate in the market.

Family size (FAMSZE): The results of Heckman two-stage also indicated that, family size was positively associated with market participation and it was statistically significant effect on tomato and onion output market participation decision. Households having more family size are more likely to participate in the markets probably due to the fact that, tomato and onion production is labour intensive; hence larger households would provide family labour required for tomato and onion production, which would eventually increase the likelihood of a household participating in the market (Chala and Chalchisa, 2017). Although the larger household, the greater its consumption demand, larger household size could provide a strong source of labour, given the fact that most rural households depend mainly on family labour.

Total cultivated land (TCLAND): As regression result of Heckman two-stage, total cultivated land affect the probability of market participation decision negatively. This shows the probability of market participation of farmers who had large cultivated land were less due to increased larger total cultivated land diminishes the correctness of input use and farmers may encounter more problems in applying farm inputs at the right time; hence inefficient use of farm inputs (Alelign et al., 2016 and Osmani and Andoni, 2017). Subsequently, households with total cultivated land can produce less amount of marketable tomato and onion production and had less chance to participate in market than the other.

Access to credit services (ACREDIT): Access to credit services positively influence farmers' likelihood to participate in tomato and onion marketing. The implication is that farm households who had access to credit services by a given amount of birr increases their participation decision in the market probability because of financial problem is solved. This means when farmers have access to credit services, the probability of farmers' orientation towards commercialization increases in the study area. This suggests that access to credit improves the financial capacity of farmers to buy improved inputs, thereby increasing production which is reflected in the marketed surplus of tomato and onion. This finding is in line that credit access had positive and significance influence on farmers' decision to participate in grain marketing (Ashenafi, 2010).

**Table 1: Heckman two step selection regression results of market participation**

| Variables                      | Participation |          | Level of participation |          |
|--------------------------------|---------------|----------|------------------------|----------|
|                                | Coef.         | Std. Err | Coef.                  | Std. Err |
| Sex of household head          | 0.34          | 0.352    | 0.78**                 | 0.319    |
| Age of household head          | -0.04**       | 0.018    | -0.07***               | 0.015    |
| Education level of HH head     | 0.47***       | 0.104    |                        |          |
| Family size                    | 0.62***       | 0.187    | 1.14***                | 0.206    |
| Total cultivated land          | -0.47*        | 0.263    | 0.17                   | 0.182    |
| Off/non-farm activities        | -0.42         | 0.282    | 0.15                   | 0.290    |
| Number of livestock owned      | 0.15          | 0.104    | -0.26**                | 0.116    |
| Fertility status of the land   | 0.46          | 0.588    | -0.34                  | 0.487    |
| Frequency of ploughing         | 0.16          | 0.153    | 0.60***                | 0.189    |
| Frequency of extension contact | 0.11          | 0.073    | 0.53***                | 0.085    |
| Access to credit services      | 0.73**        | 0.303    | 0.42                   | 0.268    |
| Constant                       | 0.56          | 1.420    | 6.24***                | 1.763    |
| Lambda ( $\lambda$ )           | -0.71*        | 0.427    |                        |          |
| Rho                            | -0.74         |          |                        |          |
| Sigma                          | 0.95          |          |                        |          |

Note: \*\*\*, \*\* and \* show 1%, 5% and 10% significance level respectively; Wald  $\chi^2(10) = 78.67$ ; Non-crop output market participant observations = 61; Participant observations = 84; Probability  $> \chi^2 = 0.000$ . Source: Author's computation from sample survey data (2021).

**3.2.2 Factors Affecting the Level of Market Participation**

Heckman second stage estimation identifies factors that determine the level of market participation in vegetables (tomato and onion) marketing by using the selection model which included the inverse Mill's ratio calculated from probit estimation of vegetable market participation. The result was presented in Table 5 above. Six variables namely sex of household head, age, family size, number of livestock owned, frequency of ploughing and frequency of extension contact were significantly found to influence the level of market participation.

Sex of household head (SEX): As result of Table 5 indicated this variable affect volume of tomato and onion sales positively and significantly at 5 percent. The positive coefficient shown that, being a male household head significantly increase the level of market participation by 0.78 kg as compared to female headed household keeping other variables constant. The reason is that, in most of the rural areas males have access to updated information than females, because male participate on different agricultural activities than females; this makes male headed households an exposure to participate in the market. Moreover, female is the one who were responsible for many household domestic activities, they may not accomplish the farming activities on time and efficiently to participate in the market (Awotide et al., 2013). This implies that, the finding from this study might be because of the fact that the male headed household tend to possess larger output than the female headed households as a result of their higher access to productive inputs (Kifle et al. 2017; Rikitu et al. 2019).

Age of household head (AGE): The age of household head negatively and significantly influences quantity of tomato and onion supplied to the market at 1 percent level of significance. The negative coefficient shown that, as age of sample household head increases by one year, their level of participation in the market decrease by 0.07 kg other things being constant. This shown that, as the age of the household head increases, the quantity of tomato and onion supplied to the market decreases. This is because when households get older and older, they tend to rent out their land or they shift to the production of lesser labour intensive farming alternatives; also the younger people are more receptive to new ideas and are less risk averse than the older people (Beneberu et al., 2018; Aman et al., 2019 and Regasa et al., 2020). This finding too agree with earlier expectation who found that age of household head had negative and significance influence on farmers' marketable supply in onion, tomato and papaya marketing (Adugna, 2009).

Family size (FAMSZE): The number of family size that the household head holds positively and significantly influences the quantity of tomato and onion supplied to the market at 1 percent level of significance. The positive

coefficient indicated that, increase in family size increases the level of market participation by 1.14 kg, citrus paribus. This implies that, as the number of family size household head holds increases, the quantity of tomato and onion supplied to the market also increases. The reason behind is obvious: a farmer who has more family size has more family labour which is the major source of labour force in the area; hence those farmers who have access to more family labour are likely to produce more quantity of tomato and onion which in turn increases the quantity of tomato and onion supplied to the market. This is in line with the findings of (Chala and Chalchisa, 2017; Degefa K, et al., 2020) those founds that a larger family size provides cheaper labour and produce more output in absolute terms which in turn increases the quantity of output to be sold.

Livestock size (LIVESZE): This variable significantly and negatively influenced the level of market participation at 5 percent significance level. The negative coefficient indicated that, increase in livestock size decreases the level of participation in the market by 0.26 kg keeping other variables constant. This result shows that if a household has livestock, the household members will need to share time and money with the livestock for feeding them and taking care of the livestock. In consequence, they will have less production surplus to sell in the market. They might need to borrow money or sell the livestock to meet the household consumption needs. On the other hand, farmers who own insufficient land for crop production may have a negative impact on their marketed surplus because they need to specialize in livestock breeding. This result was in line with the study by Chala and Chalchisa (2017). Therefore, farm households who have large livestock size in tropical livestock unit (TLU) could supply less amount of tomato and onion to the market than others in the study area.

Frequency of ploughing (FREQPLOU): This variable significantly and positively affect volume of tomato and onion marketed at 1 percent significance level. The positive coefficient indicated that, increase in number of ploughing increases the level of participation in the market by 0.60 kg other things being constant. The reason behind is that when farmer increase the number of ploughing up to the recommended times, production and productivity of tomato and onion also increased; which directly increases volume of supply to the market (Bekabil et al., 2011). This gives them better position to supply more marketable product. Therefore, farmers with the number of ploughing were participate in the market with greater level of participation compared to else.

Frequency of extension contact (EXTEN): As result of Table 5 indicated this variable influences the quantity of tomato and onion to be sold in the market positively and it was statistically significant at the level of 1 percent. The coefficient indicated that, an increase in number of extension contact increases the level of participation in the market by 0.53 kg, citrus paribus. The positive relationship shows that extension services usually provide information on market availability and improved varieties that enhance the farmer's knowledge of production. The results demonstrate the importance of improved technology and support for services in promoting tomato and onion sales in the market that the coefficient of extension services was positive and significantly influenced the production of tomato and onion (Beneberu et al., 2018; Aman et al., 2019; Degefa K, et al., 2020). Consequently, tomato and onion sold among smallholder farmers were also affected.

**4. CONCLUSION AND RECOMMENDATIONS**

In Ethiopia, increasing population pressure and low levels of agricultural productivity have aggregated the food insecurity situation by widening the gap between demand for and supply of food. Rising productivity to increase market participation with its level of participation in crop production could be taken as an important step towards attaining food security.

Out of the total interviewed households 61(42.07%) of them were market participant while the remaining 84(57.93%) were non-market participant. Heckman two-step procedure was used to analyze the determinants of participation in tomato and onion markets and volume of sales during the study period. Accordingly, the outcomes of the model shown that, family size, education level and access to credit services were significantly and positively affected market participation decision, while age of household head and total cultivated land had significant and negative effect on market participation decision of sampled farmers. Further, results from Heckman two-step indicated that sex of household head, family size, frequency of ploughing and extension contact affect the level of market participation significantly and positively, while age of household head and number of livestock owned had significant and negative effect on level of participation in tomato and onion markets. Marketing of agricultural product plays a critical role in meeting the

overall goals of sustainable agriculture, food security and poverty alleviation, particularly among smallholder farmers in rural areas.

Furthermore, given the findings highlighted above, it is clear that the integration of rural smallholders into market participant cannot be achieved without effective policy interventions that create sustain and enabling environment for greater participation. This would include improving land access (which would require the involvement of government to administer and instigate a proper, consistent and equitable distribution of land to rural households); improving road infrastructure; providing extension services and making available relevant advice and information related to both production and marketing aspects; and enhancing both credit and production input accessibility.

In all aspects, government support is crucial, but its interventions need to be based on a thorough understanding of the effect of each factors on smallholders' productivity, market participation and quantity marketed. Most importantly, government needs to understand that each of these key factors can never function in isolation from the others. For example while accepting that land is an important agricultural resource, it must be recognize that land is not the only key factor to increasing productivity and enhancing market participation. No amount of land will help rural agricultural households unless complementary investments are made in productive technologies and infrastructure, government support services, agricultural training and marketing systems.

At the end, the government should focus on follow-up activities in vegetables (tomato and onion) production and marketing policy, not only enhancing accessibilities to market for smallholder vegetable farmers, so that vegetable sales and the market participation of farmers can develop.

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