Factor affecting outlet choice of onion producers Northwest Ethiopia in multivariate probit approach

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Abstract: Onion is an important vegetable product for food security and income generation to a large proportion of the rural household of Ethiopia. Enhancing onion farmers to reach markets and actively engage in the markets as a key challenges influencing onion production in Ethiopia. The perishability nature of onion necessitates an effective marketing channel choice decision. So the objective of this study was the analysis of factors affecting market outlet choice decision of farmers. Multistage sampling procedure was used to select the sample kebeles and households, whereby 275 farm household using a stratified random sampling method for this study. Both primary and secondary data were collected to address the objectives. The collected data were analyzed using descriptive statistics and an econometric model by using SPPS and STATA software. Multivariate probit model was used to analyze factors affecting market outlet choices of smallholder onion producers. Multivariate probit model result showed that the probability of choose wholesales, retailer, rural collectors, and consumers market outlet was significantly affected by post-harvest value addition, amount of onion production, land size allocated for onion production, ownership of motor pump, educational status of the household head and the total livestock owned. Based on the finding the government and the
concerned stakeholders should focus on promoting the dissemination of improved onion varieties and input of production, intensification of land for onion, expanding of post-harvest value addition activities, strengthening of the existence of formal and informal education and promote and encourage onion farmers on investment onion production.

Subjects: Agriculture & Environmental Sciences; Food Chemistry; Food Engineering

Keywords: fogera; supply chain; multivariate probit model

1. Introduction
Onion (*Allium cepa* L. var. *cepa*) production is an important economic activity in Ethiopia ranging from smallholder farmer to large-scale commercial farms (Dessalegn, Assefa, Derso, & Haileslassie, 2016), while smallholders usually use the largest part of their vegetable produce for home consumption like local stew “wot” (Fekadu & Dandena, 2006) and sell the surplus, the commercial state and private farms produce solely for market (Nigatu, 2016). Onion use in the daily diet of most Ethiopians and the average daily consumption was estimated 15 g, which is higher than tomatoes and the most other vegetables (Kitata & Chandravanshi, 2012).

Amhara National Regional State is an agrarian region where more than 85% of its population is living in the rural area and practicing crop production as their source livelihood (Lemenih, Feleke, & Tadesse, 2007). The region is endowed with favorable environmental conditions and plenty of natural resources that are required for the production of crops including major root crops and other horticultural crops particularly onion (Tadesse, 1989).

According to CSA (2016/17) in Meher season, the average national onion production reached about 97.45 qt/ha, whereas in the ANRS 116.77 qt/ha this indicates that slightly over half of this was produced in the ANRS to national level. During cropping season, the total area planted with onion went down both national and regional level considerably. The low productivity could be attributed to the limited availability of quality seeds and associated production technologies used, low market integrated among the others, lacks of infrastructure and postharvest losses it accounts for about 10.7% and 30% for onions and other vegetables, respectively (Adgo, 2008; Giziew, 2019). Fogera is one of the onions producing woreda and has tremendous potential for onion cultivation for both consumption and market. Due to the availability of ample irrigated farmland and rain feed agro ecology and topographical structure of the area, farmers are growing Adama red and Bombay red varieties in their fields in rural areas, even onion is highly consumed not only in regular dishes but in other ceremonial events.

2. Material and method

2.1. Description of the study area
The study was conducted in South Gondar Zone of Amhara region particularly in Fogera hosting a total of 48 068 households of which the majority is male household 41,370 and 6698 female household and it bordered on the south by Dera, on the west by Lake Tana, on the north by the Rib which separates it from Kemekem, on the northeast by Ebenat, and on the east by Farta with that of the altitude ranges from 1774 to 2415 m above sea level (FWOA, unpublished 2018) (See Figure 1). Depending on this information, South Gondar zone was selected as a study area based on major reasons: different scholarly kinds of literature reported that the onion is threatened by market dis orneriness and lack of postharvest handling activities; to fill information gaps of previous studies and different international projects have been attracted by the onion producers found in South Gondar zone and the need of quick and suitable market supply of onion both inside of the country and outside the border.
2.2. Data type, sample size and sampling procedure

For a quantitative research, the probability sampling technique is appropriate as compared to a non-probability sampling technique because samples drawn by using probability sampling techniques are more representative than non-probability sampling techniques. Accordingly, a multi-stage random sampling technique was used for this study. In the first step, the total onion producers’ kebeles available in the woreda were grouped into two strata on the basis of agroecological and geographical elevation of existing rice production farming system (upland and lowland rice-producing system) (Melese, Goshu, & Tilahun, 2018). Then, the total of twelve kebeles (comprising 17,790 households), eight lowland, and four upland kebeles are found in the woreda. In the second stage, a two-step approach was followed; first to select two kebeles randomly from lowland stratum and one kebele from upland stratum and then to draw the sample respondents from each selected kebeles. Accordingly, Woreta zuryai (109) & Quhar Michlae (111) were selected from lowland and Adis Betkstiy (55) was selected from upland as representatives of the total kebeles in the respective agro-ecologies. Finally, total samples of 275 rural households were chosen from these three kebeles following a sampling procedure of probability proportional to sample size.

2.3. Methods of data analysis

Descriptive statistics and econometric analysis were used to analyze the data obtained from onion supply chain actors to address the objective. Descriptive analysis of data mainly uses frequency, percentage, mean and standard deviations. Econometric analysis was used to estimate the causal relationship between the dependent variable and repressors’. It is pertinent to understand the effect of different repressors’ on market outlet choice by smallholder onion producers. The goal of the market outlet choice decision is to explain the effects of the independent variables on the probability of choosing between different market outlets in the onion supply chain.

The producers’ selection of market outlet depends on the amount of utility obtained from alternative market outlets. The possible outcome of market outlet choice can be modeled
following random utility formulation. A Market outlet which has a greater level of expected utility as compared to other market outlet is supposed to be chosen by the farmer (Masten & Saussier, 2000). Consider the $i^{th}$ farm households ($i = 1, 2, \ldots, N$), facing a decision problem on whether or not to choose available market outlets. Let $V_0$ represent the utility expected to obtain by the farmer who chooses $K^{th}$ market outlet and $V_k$ represents the actual utility of farmer to choose the $K^{th}$ market outlet: where $K$ denotes a choice of wholesalers ($Y_1$), retailers ($Y_2$), collectors ($Y_3$) and consumers ($Y_4$) of market outlet. The farmer decides to choose the $K^{th}$ market outlet if $Y_{ik} = V_{ik} - V_0 > 0$. The net benefit that the farmer derives from choosing a market outlet is a latent variable determined by observed explanatory variable ($X_i$) and the error term which represent an observed utility ($e_i$):

$$Y_{ik} = B_kX_{ik} + e_i (K = Y_1, Y_2, Y_3, Y_4)$$

Where, $B_k$ is the vector of parameter. $K$ represents a different level of utility from the different market outlet ($Y_i$). Using the indicator function, the unobserved preferences translate into the observed binary outcome equation for each choice as follows:

$$Y_{ik} = \begin{cases} 1 & \text{if } y_{ik} > 0 \\ 0 & \text{otherwise} \end{cases} (K = Y_1, Y_2, Y_3, Y_4)$$

where $Y_{i1} = 1$, if farmers choose Retailer (0 otherwise), $Y_{i2} = 1$, if farmers choose Wholesaler (0 otherwise), $Y_{i3} = 1$, if farmers choose rural collector (0 otherwise) and $Y_{i4} = 1$, if farmers choose consumer (0 otherwise).

In multivariate model, where the choice of several market outlets is possible, the error terms jointly follow a multivariate normal distribution (MVN) with a mean of zero and variance–covariance matrix $V$ has values of 1 on the leading diagonal and correlation $\rho_{jk} = \rho_{kj}$ as off-diagonal element where $(\mu_{Y_1}, \mu_{Y_2}, \mu_{Y_3}, \mu_{Y_4})$ MVN ~ $(0, \Omega)$ and the symmetric variance-covariance matrix $\Omega$ is given by:

$$\Omega = \begin{bmatrix} 1 & \rho_{y_1y_2} & \rho_{y_1y_3} & \rho_{y_1y_4} \\ \rho_{y_2y_1} & 1 & \rho_{y_2y_3} & \rho_{y_2y_4} \\ \rho_{y_3y_1} & \rho_{y_3y_2} & 1 & \rho_{y_3y_4} \\ \rho_{y_4y_1} & \rho_{y_4y_2} & \rho_{y_4y_3} & 1 \end{bmatrix}$$

Off-diagonal elements in the variance—covariance matrix represent the unobserved correlation between the stochastic components of the different types of outlets. This assumption means that it will generate MVP models that jointly represent a decision to choose a particular market outlet. This specification with non-zero off-diagonal elements allows for correlation across error terms of several latent equations, which represents unobserved characteristics that affect the choice of alternative outlets. Following the form used by (Cappellari & Jenkins, 2003), the log-likelihood function associated with a sample outcome is then given by;

$$\ln L = \sum_{i=1}^{N} \omega_i \ln \Phi(\mu_i, \Omega)$$

where $\omega$ is an optional weight for observation $i \ldots N$ and $\Phi$ is the multivariate standard normal distribution with arguments $\mu_i$ and $\Omega$, where $\mu_i$ can be denoted as:

$$\mu_i = (K_{i1}\beta_{X_{i1}}, K_{i2}\beta_{X_{i2}}, K_{i3}\beta_{X_{i3}}, K_{i4}\beta_{X_{i4}}), \text{ while } \Omega_{ik} = 1 \text{ for } J = K \text{ and}$$

$$\Omega_{jk} = \Omega_{kj} = K_{ik}K_{jk}\rho_{jk} \text{ for } J = K, K = 1, 2, 3 \ldots \text{ with } k_{ik} = 2y_{ik}-1 \text{ for each } i, k = 1 \ldots 4.$$
3. Result and discussion

3.1. Demographic and socioeconomic characteristics of sampled respondents

The results of the study indicated that 79.27% of onions producing households were male-headed whereas, the remaining 20.73% were female-headed household heads. Onion producers in the study area sell their product into four market outlet. These were wholesalers which accounts for 87.64% of total sells followed by retailers which accounts for 86.91%, rural collectors (82.91%) and consumers (79.22%) respectively. The mean household characteristics by onion market outlets are provided in Table 1 below. The mean household size which had access to the retailer, wholesaler, rural collector and consumer onion market outlets was 5.743, 5.736, 5.785 and 5.75 per onion product, respectively. The average distance traveled for onion producers sold to the consumer market outlet was on average 37.830 min away from the nearest market while those sold for wholesalers, rural collector and retailers’ market outlet are located on average 38.112, 38.276 and 38.334 min away from home, respectively. The average proportion of onion production of household characteristics by onion market outlets accessed by the retailer, rural collector, wholesaler, and consumer market outlet was 39.629, 40.589, 40.831 and 41.325 quintals of onion per hectare was accessed, respectively (Table 2).

Educational status of the respondents who sold to the retailer (62.76%), wholesaler (64.73%), rural collector (62.72%) and consumers (66.51%) market outlets had attending formal and informal education. The proportion of the respondents who male household headed sold (88.70%) to the retailer (89.63%) to wholesaler (89.04%) rural collector and (89.45%) consumers market outlets. The results on motor pump ownership indicate that 48.55%, 48.95%, 50.44% and 53.21% of market participants sold onion to wholesaler, retailer, rural collector, and consumer, respectively, as the choice of marketing outlets. In terms of postharvest value addition activities 84.1%, 85.48%, 85.53% and 87.61% onion producers made postharvest value addition activity and sold their product to the corresponding retailer, wholesaler, rural collector and consumer market outlet which involved in onion trading activities.

On the other hand, about 77.06% of respondents make market contract agreement and sell their product to a consumer, whereas the remaining 78.07%, 78.66% and 79.67% of the respondents make an agreement and sell their product to the rural collector, retailer and wholesaler market outlet had taken credit for onion production and marketing, respectively. In the case access to credit take 11.93%, 12.55%, 12.72%, and 13.28% of the sample respondents take credit and sold onion to a corresponding consumer, retailer, rural collectors, and wholesaler market outlets. Finally, the results

| Variable                        | Retailer       | Wholesaler     | Rural collector | Consumer     |
|---------------------------------|----------------|----------------|-----------------|--------------|
| Household size (manequv)        | 5.743 (1.551)  | 5.736 (1.562)  | 5.785 (1.566)   | 5.75 (1.58)  |
| Livestock ownership (TLU)       | 8.577 (2.519)  | 8.428 (2.544)  | 8.474 (2.614)   | 8.30 (2.444) |
| Area of land for onion (ha)     | 0.342 (0.172)  | 0.352 (0.176)  | 0.358 (0.180)   | 0.349 (0.178)|
| Amount onion production (qt)    | 39.629 (15.680)| 40.831 (15.290)| 40.589 (16.179)| 41.325 (15.676)|
| Frequency of extension contact  | 22.405 (10.740)| 22.983 (10.598)| 23.030 (10.617)| 23.302 (10.616)|
| Distance to nearest market      | 38.334 (15.456)| 38.112 (15.701)| 38.276 (15.540)| 37.830 (15.675)|
on access to market information indicate that 88.28%, 88.38%, 89.47% and 89.91% of market participants used retailer, wholesaler, rural collector and consumer market outlet, respectively.

3.2. Factors onion market outlet choices

Farmers who produce onion in Fogera district have four alternative market outlet choices for selling onion. These are retailer, wholesales, rural collectors and consumers. Multivariate probit was used to analyze the onion producers’ market outlet choices among four different outlets included in the model. In this section, the significance of the determinants influencing producers’ decision in market outlet choice is discussed based on the results of the multivariate probit (MVP) model.

The Wald test ($\chi^2 = 430.59$, $p = 0.00$) is strongly significant at 1% significant level, which indicates that the subset of coefficients of the model is jointly significant and that the explanatory power of the factors included in the model is satisfactory, thus, the MVP model fits the data reasonably well. The simulated maximum likelihood test (LR $\chi^2 (6) = 17.965$($\text{Prob} > \chi^2 = 0.0063$) of the null hypothesis of independence between the market outlets decision ($p_{21} = p_{31} = p_{41} = p_{32} = p_{42} = p_{43} = 0$) is significant at 1% significant level. Therefore, the null hypothesis that all the $p$ (Rho) values are jointly equal to 0 is rejected, indicating the goodness-of-fit of the model and supporting the use of the MVP model over individual probit model. This verifies that separate estimation of choice decision of these outlets is biased, and the decisions to choose the four onion marketing outlets are interdependent household decisions (Table 3).

The simulation maximum likelihood (SML) estimation result indicates the marginal success probability of each four market outlets. The likelihood of choosing wholesale market outlet (87%) was relatively high as compared to the probability of choosing retailer (86%), rural collectors (82%) and consumer outlet (79%). With regard to the joint probabilities of success and failure of the market, outlet choice decisions suggest those households are more likely to jointly choose four market outlets. The likelihood of households to jointly choose the four market outlet is 59% compared to their failure of 0.7% to jointly choose the four market outlets.

| Variables          | Category           | Retailer (%) | Wholesaler (%) | Rural collector (%) | Consumer (%) |
|--------------------|--------------------|--------------|----------------|---------------------|--------------|
| Sex HH             | Male               | 88.70        | 89.63          | 89.04               | 89.45        |
|                    | Female             | 11.30        | 10.37          | 10.96               | 10.55        |
| Education status   | Literate           | 62.76        | 64.73          | 62.72               | 66.51        |
|                    | Illiterate         | 37.24        | 35.27          | 37.28               | 33.49        |
| Own motor pump     | Yes                | 48.95        | 48.55          | 50.44               | 53.21        |
|                    | No                 | 51.05        | 51.45          | 49.56               | 46.76        |
| Market contract    | Yes                | 78.66        | 79.67          | 78.07               | 77.06        |
|                    | No                 | 21.34        | 20.33          | 21.93               | 22.94        |
| Post harvest value add | Yes         | 84.10        | 85.48          | 85.53               | 87.61        |
|                    | No                 | 15.90        | 14.52          | 14.47               | 12.39        |
| Market info        | Yes                | 88.28        | 88.38          | 89.47               | 89.91        |
|                    | No                 | 11.72        | 11.62          | 10.53               | 10.09        |
| Credit take        | Yes                | 12.55        | 13.28          | 12.72               | 11.93        |
|                    | No                 | 87.45        | 86.72          | 87.28               | 88.07        |

Source: own survey (2019).
The \( \rho \) values (\( \rho_{ij} \)) indicate the degree of correlation between each pair of dependent variables. The \( \rho_{21} \) (correlation between the choice for wholesaler and retailer), \( \rho_{31} \) (correlation between the choice for rural collector and retailer) and \( \rho_{41} \) (correlation between consumers and retail) are negatively interdependent and significant at 1% and 5% probability level, respectively. \( \rho_{32} \) (correlation between the choice for rural collector and wholesale), \( \rho_{42} \) (correlation between the choice for consumer and wholesale) and \( \rho_{43} \) (correlation between the choice for consumer and rural collectors) are positively interdependent and significant at 10% significant level. From this finding, it is possible to conclude those onion producers delivering to wholesalers are less likely to a retailer and vice versa and also rural collector are less likely to deliver retailer and vice versa, likewise, those producers delivering consumer are less likely to a retailer and vice versa. This indicates a competitive relationship of a wholesale market outlet with a local collectors’ market outlet.

Equally, there was a competitive relationship between retailer market outlet with wholesaler and consumer market outlet. However, those onion producers delivering to the rural collector are more likely to deliver to wholesaler and consumer and vice versa. This indicates a complementary relationship of a wholesale market outlet with a rural collector and consumer outlet. Based on the result of the MVP model, two of the variables used in the model were significant at four market outlets, Some of the variables used in the model were also significant at more than one market outlets while some others were significant in one market outlet but not in the other outlet. Out of thirteen explanatory variables included in a multivariate probit model, three variables significantly affected wholesaler market outlet, retailer and rural collectors’ outlet and four variable significantly affected consumer outlet choices at 1, 5 and 10% probability levels.

### Table 3. Overall fitness, probabilities and correlation matrix of the market outlets from the MVP model

| Market outlet | Retailer | Wholesaler | Rural collector | Consumer |
|---------------|----------|------------|----------------|-----------|
| Predict probability | 0.870 | 0.872 | 0.829 | 0.796 |
| Joint probability (success) | 0.594 | | | |
| Joint probability (failure) | | | | 0.007 |
| Number of drawn (#) | | | | 5 |
| Observation | | | | 275 |
| Lag likelihood | | | | 335.417 |
| Wald \( \chi^2(52) \) | | | | 203.18 |
| Prob > \( \chi^2 \) | | | | 0.00*** |
| \( \rho \) | | | | |
| \( \rho_{11} \) | | | | |
| \( \rho_{12} \) | -0.536***(0.114) | | | |
| \( \rho_{13} \) | -0.304**(0.129) | 0.274*(0.149) | | |
| \( \rho_{14} \) | -0.310**(0.136) | 0.235*(0.134) | 0.249*(0.138) | |

Likelihood ratio test of \( \rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0 \):

\[
\chi^2 (6) = 17.765
\]

Prob > \( \chi^2 \) = 0.0068

***, ** and * indicate statistical significance at 1 and 10, respectively. \( \rho_1 \) = retailer, \( \rho_2 \) = wholesaler, \( \rho_3 \) = rural collectors and \( \rho_4 \) = Consumers, Parenthesis in the disturbance term correlation matrix showed the standard error (SE). Source: Own computation from survey result, (2019).
3.2.1. Quantity produced (Amprd)
This variable is associated positively for three markets outlet chooses of onion market in the study area at 10% significant level at retailer market outlet and 1% significant level at wholesaler and consumer market outlets. The probability of choosing the retailer market outlet was positively and significantly affected by the quantity produced at 10% significant level and the probability of choosing wholesaler and consumer market outlet was positively and significantly affected by the quantity produced at 1% significant level. The positive sign indicates that those households producing a large quantity of onion mostly prefer to use wholesaler consumer and retailer market outlets, respectively, than rural collector mark outlet. On the other hand, households who produce a large amount of onion accessed wholesaler, consumer and retailer market outlets compared to households who supply less because of the capacity to purchase a large amount of onion with fair price, respectively. The implication is that if the quantity of onion to be produced a large amount the farmers prefer a market outlet which buys large volume with a fair price. But, if the quantity to be produced is low, farmers are not forced to search price and market information. This finding agrees with (Xaba & Masuku, 2013) who found that farmers with a large number of mango trees were more likely to sell to the export market relative to brokers.

3.2.2. Post-harvest value addition (PHVA)
Post-harvest value addition by the farmer was positively and significantly with the expected result choosing wholesalers, retailers, rural collector and consumer market outlets at 1% significant level. The positive sign indicates that those households producing a large amount of onion mostly prefer to use more market outlets interchangeably. Farmers who have practiced post-harvest value addition (properly storage, grading or sorting, cutting and cleaning) mostly prefer by all four market outlets to sell their produces with the fair market price. The probable reason might be related with poor quality and perishable onion which is not preferred by ultimate consumers and traders to purchase and to sell with better market price. This is in line with the finding by (Muthini, 2015) who revealed that the post-harvest value addition of potato has a significant and positive relation with the likelihood of choosing collector and wholesaler only channel at 1% level of significant.

3.2.3. Education level (Edu HH)
Education level of onion producers has a significant and positive effect on the chances of choosing wholesalers and consumer market outlets choice at 5% and 1% significant level, respectively (Table 4). Education is believed to give individuals with the necessary knowledge that can be used to collect information, interpret the information received, and make products and marketing decision. This result shows that farmers who literate would more likely sell onion to wholesalers and consumer than other market outlets because more educated farmers may go to spend less time doing marketing activities. This finding was in line with the findings of (Abraham, 2013) that education level is negatively and significantly related to collectors’ market outlet, thus, households preferred wholesalers’ market outlet. The possible reason might be that as the level of education increases farmers’ productivity increases and strengthen the linkage with wholesalers and consumer. Education increases the knowledge of farmers that can be used to collect information, interpret the information received, and make informed and marketing decisions.

3.2.4. Ownership of motor pump (own-motor)
Ownership of the motor pump had a positive and significant influence on the choice of consumer outlet at 5% probability level. The positive sign shows that farmers who had own motor pump are more likely to sell onion to consumer outlet compared to those farmers who had not. This might implies that farmers who had own motor pump for irrigation produce more onion and thus deliver their product to any of the available outlets compared to those farmers who had not. This finding congruent to (Hailu, 2017) Ownership of motor pump had a positive and significant influence on the choice of consumer outlet at 10% probability level.
Table 4. Multivariate probit estimations for factor affecting onion producers’ market outlets choice

| Variables                          | Wholesaler |          | Retailer |          | Rural collector |          | Consumer |          |
|------------------------------------|------------|----------|----------|----------|-----------------|----------|----------|----------|
|                                   | Coff       | SE       | Coff      | SE       | Coff            | SE       | Coff      | SE       |
| Sex HH                            | 0.194      | 0.432    | 0.276     | 0.347    | 0.454           | 0.349    | 0.291     | 0.331    |
| Edu status of HH                  | 0.681**    | 0.277    | -0.031    | 0.223    | 0.178           | 0.214    | 0.757***  | 0.224    |
| Household size                    | -0.014     | 0.095    | 0.040     | 0.072    | 0.086           | 0.072    | -0.017    | 0.072    |
| Livestock ownership (TLU)         | 0.017      | 0.059    | 0.103**   | 0.046    | 0.044           | 0.045    | -0.041    | 0.043    |
| Area allocated for onion          | 0.249      | 1.019    | -0.752    | 0.681    | 2.047**         | 0.873    | -0.206    | 0.730    |
| Amount of produced                | 0.094***   | 0.022    | 0.019*    | 0.011    | 0.008           | 0.013    | 0.035***  | 0.013    |
| Own motor pump                    | -0.456     | 0.332    | -0.027    | 0.249    | 0.315           | 0.241    | 0.500**   | 0.243    |
| Market contract                   | 0.123      | 0.316    | 0.174     | 0.240    | -0.062          | 0.258    | -0.326    | 0.269    |
| Post harvest value add            | 0.914***   | 0.309    | 0.756***  | 0.244    | 0.724***        | 0.247    | 0.799***  | 0.239    |
| Market information                | 0.025      | 0.335    | 0.286     | 0.273    | 0.405           | 0.270    | 0.288     | 0.265    |
| Extension services                | -0.030     | 0.023    | 0.004     | 0.014    | 0.018           | 0.015    | 0.008     | 0.015    |
| Credit take                       | 4.443      | 109.946  | 0.413     | 0.400    | 0.323           | 0.378    | -0.309    | 0.331    |
| Distance to nearest market        | -0.009     | 0.0097   | -0.000    | 0.007    | -0.000          | 0.0067   | -0.007    | 0.007    |
| Constant                          | -2.085**   | 1.051    | -1.675**  | 0.838    | -2.777***       | 0.887    | -1.145    | 0.823    |

***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively, SE is standard error. Source: Own computation from survey result (2019).
3.2.5. Livestock owned (TLU)

The model result showed that total livestock owned of the household was positively associated with the retailer market outlet at 5% significant level. The positive relationship indicates that farmers having large total livestock are able to purchase more input for onion production intern produce more quintal of onion and supplied a large quantity of onion to the retailer market outlet. In the other cases, farmers with more livestock assets have better animal manure for input production which helps to increase productivity and production and finally farmers would supply more onion to retailer market outlet. This study in line with (Kuma, Baker, Getnet, & Kassa, 2013) confirmed that livestock hold had positively and significantly affected the access of milk market outlet.

3.2.6. Land allocated for onion

Finally, as expected, farmers who allocated more land for onion production positively and significantly associated with the choice of rural collector outlet chose at 5%, level of significant. This is in line with the study of (Woldie & Nuppenau, 2009) and (Kuma et al., 2013) who found that large land size allocated for banana and potato positively and significantly affects the proportion sold to wholesaler traders and cooperative milk market outlets, respectively.

4. Conclusions and recommendations

Descriptive statistic result indicates that out of 275 total respondents, 79.27% male headed and the remaining 20.73% were female-headed households. These were wholesalers which accounts for 87.64% of total sells followed by retailers which accounts for 86.91% rural collectors (82.91%) and consumers (79.22%) respectively. The multivariate probit model applied in this study was specifically intended to socio-economic factors influencing the onion producer’s choice of market outlets. The correlation between the choice for wholesaler and retailer, the correlation between the choice for rural collector and retailer and correlation between consumers and retail were negatively interdependent and significant, respectively, and they had a competitive relationship of a wholesale market outlet with local collectors’ market outlet. Equally, there was a competitive relationship between retailer market outlet with wholesaler and consumer market outlet. The correlations between onion producer’s choice of retailer and wholesaler, rural collector and retailer and consumer and retailer outlet were negatively and statistically significant, this indicates competitive relationship and correlation between rural collector and wholesaler, consumer and wholesaler and consumer and rural collectors’ outlet was also positively and statistically significant. This indicates that complementary relationship. This study has also shown that the onion farmers in the study area have made their choice of market outlets for their produce based on the amount of onion produced, educational status, land allocated for onion, post-harvest value addition, ownership of motor pump and total livestock owned. Based on the finding the woreda agriculture office experts, onion producers government and the concerned stakeholders should focus on promoting the dissemination of improved onion varieties and input of production, intensification of land for onion, expanding of post-harvest value addition activities, strengthening of the existence of formal and informal education and promote and encourage onion farmers on investment onion production.

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Competing interests

The authors declare that they have no competing interests.

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References
Abraham, T. (2013). Value chain analysis of vegetables: The case of Habro and Kombolcho Woredas in Oromia Region, Ethiopia. (An MSc Thesis presented to the School of Graduate Studies of Haramaya University, p. 78.

Adgo, T. (2008). Farmers’ evaluation and adoption of improved onion production package in Fogera District, South Gondar, Ethiopia. Haramaya University.

Coppellari, L., & Jenkins, S. P. (2009). Multivariate probit regression using simulated maximum likelihood. The Stata Journal, 3(3), 278–294. doi:10.1177/1536867X09003003005

Dessalegn, Y., Assefa, H., Derso, T., & Haileslassie, A. (2016). Assessment of fruit postharvest handling practices and losses in Bahir Dar, Ethiopia. African Journal of Agricultural Research, 11(52), 5209–5214. doi:10.5897/AJAR2016.11731

Emana, B., Afari-Sefa, V., Dinssa, F. F., Ayana, A., Balemi, T., & Temesgen, M. (2015). Characterization and assessment of vegetable production and marketing systems in the Humid Tropics of Ethiopia. Quarterly Journal of International Agriculture, 54 (852–2016–65246), 163–187.

Fekadu, M., & Dandena, G. (2006). Review of the status of vegetable crops production and marketing in Ethiopia. Uganda Journal of Agricultural Sciences, 12(2), 26–30.

Giziaw, A. (2019). Analysis of gender and determinants of market supply of onion in Dugda District, East Shoa, Ethiopia. Journal of Agriculture and Environmental Sciences, 3, 1.

Hailu, A. (2017). Determinants of Volume Sales among Smallholders Potato Farmers in Ejere District, West Shoa Zone, Oromia Region of Ethiopia.

Kitatu, R. B., & Chandravanshi, B. S. (2012). Concentration levels of major and trace metals in onion (Allium cepa L) and irrigation water around Meki Town and Lake Ziway, Ethiopia. Bulletin of the Chemical Society of Ethiopia, 26(1).

Kuma, B., Baker, D., Getnet, K., & Kassa, B. (2013). Factors affecting milk market outlet choices in Wolaita zone, Ethiopia. African Journal of Agricultural Research, 8 (21), 2493–2501.

Lemenih, M., Feleke, S., & Tadesse, W. (2007). Constraints to smallholders production of frankincense in Metema district, North-western Ethiopia. Journal of Arid Environments, 71(4), 393–403. doi:10.1016/j.jaridenv.2007.04.006

Mosten, S., & Sausser, S. (2000). Econometrics of contracts: An assessment of developments in the empirical literature on contracting. Revue d’économie industrielle, 92(1), 215–236.

Melese, T., Goshu, D., & Tilahun, A. (2018). Determinants of outlet choices by smallholder onion farmers in Fogera district Amhara Region, Northwestern Ethiopia. Journal of Horticulture and Forestry, 10(3), 27–35. doi:10.5897/JHF2018.0524

Muthini, D. N. (2015). An assessment of mango farmer’s choice of marketing channels in Makueni, Kenya. Nigatu, M. (2013). Assessment of onion production practices and effects of N P2O5 S fertilizers rates on yield and yield components of onion (Allium cepa L) under irrigated farming system in Dembali District, Amhara Region, Ethiopia. Bahir Dar University.

Todesse, F. (1989). Post-harvest losses of fruits and vegetables in horticultural state farms. Paper presented at the I International Symposium on Horticultural Economics in Developing Countries (p. 270).

Woldie, G. A., & Nuppenau, E. (2009). Channel choice decision in the Ethiopian banana markets: A transaction cost economics perspective. Journal of Economic Theory, 3(14), 80–90.

Xaba, B. G., & Masuku, M. B. (2013). Factors affecting the choice of marketing channel by vegetable farmers in Swaziland. Sustainable Agriculture Research, 2(526–2016–37887).
