Econometric analysis of onion marketed supply in Northwest Ethiopia

Habtamu Mossie1*, Zewdu Berhanie2 and Getachew Alemayehu2

Abstract: Fruit and Vegetables are growing both rain fed and irrigation in Ethiopia and important for food security and income generation to a large proportion of the rural household. Enhancing onion farmers to reach markets and actively engage in the markets key challenges influencing onion production in Ethiopia. So the study aimed to analyze determinates of onion market supply. The study specifically aimed to address determinates that affecting onion production and market supply of rural households. A total of 275 households were selected using a multi-stage sampling technique followed by a probability proportional to sample size. The result indicated that in the study area 79.27% of onions producing households were male-headed whereas, the remaining 20.73% were female-headed household heads. On the other hand model results show that sex, age, household size, land size, motor pump, marketing contract, post-harvest value addition and market information positively and significantly affected the volume of onion supplied to the market. The findings imply that policymakers as well as policies designed at national level should consider on promoting the market contract, dissemination of improved onion varieties and input of production, intensification of land, expanding of post-harvest value addition activities and expanding the existence of irrigating equipments.

ABOUT THE AUTHOR
Habtamu Mossie was born Deber Elias Woreda, East Gojjam Zone of Amhara Regional State in Semepeteb 1993. He also attended his elementary, secondary and preparatory school education at Deber Elias Secondary and Preparatory High School in East Gojjam zone. After completion of his high school education, he joined Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) in October 2013 and graduated with BSc Degree in Agricultural Economics in June 25/2015. Soon after his graduation, Assistance Lecturer I employed him at Wolkite University. After two year experience the author joined Bahir Dar University College of Agriculture and Environmental since in October 2018 to pursue of his MSc degree in Agricultural Economics in regular program. After the accumulation of my master degree I joined Injibar University College of agriculture, food and climate as Lecturer in department of Agricultural Economics.

PUBLIC INTEREST STATEMENT
Fruits and vegetable crops are grown in Ethiopia under rain-fed and/or irrigation system. Though its role on human nutrition, health, farm income generation, poverty alleviation and foreign currency earnings through export and foreign direct investment, so the smallholder farmers who produce onion there should be select lacerative market outlet, the current level of onion production and marketing is not at its optimum level due to immense internal and external factors. Therefore, the author is highly interested to recommend a collaborated work between the government and farm households to encourage this product.
1. Introduction
Fruits and vegetable crops are grown in Ethiopia under rain-fed and/or irrigation systems (Sara Belay, Mideksa, Gebrezgiabher, & Seif, 2015). Onion (Allium cepa L. var. cepa) is a root vegetable which heavily depends on weather conditions, bulky in nature, perishable (Asale, Yhanes, & Buke, 2016). The production highly characterized by irregular supply, varied quality and seasonality of the products needs the main actors along the market chain to have the necessary infrastructure to keep quality and reduce post-harvest loss of a product until it reaches to the final consumer. This leads to sensitive to price and production fluctuation which is an implication that it demands effective, efficient storage, transportation and distribution systems (Alemayehu, Hoekstra, Berhe, & Jaleta, 2010; Faris, Shumeta, & Muche, 2018). Onion also have a vital role in human nutrition, health, farm income generation, poverty alleviation and foreign currency earnings through export and foreign direct investment (Fekadu & Dandena, 2006) and sell the surplus, the commercial state and private farms produce solely for the market (Nigatu, 2016).

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 (CSA, 2016/17). This and implication during the cropping season, the total area planted with onion went to considerably down at both national and regional levels. The low productivity could be attributed to the limited availability of quality seeds and associated production technologies used, low market integration among the others, lacks of infrastructure and postharvest losses it accounts account for about 10.7% and 30% for onions and other vegetables, respectively (Adgo, 2008; Giziew, 2019). For that matter there need more comprehensive study which rigorously market supply of onion why because, usually farmers in Fogera focused more on the production part without having priori, adequate market information or low market awareness of farmers that helps to take into account the key marketing factors like who were bought their harvest, what are the quality preference and controlling mechanisms, time of delivery and also the possible supply increase as other farmers were also increase their production by looking at previous year price, storage facilities, transportation, price settings about the demand for their products, and weak bargaining power of farmers and underdeveloped industrial sectors (Haji, 2008).

2. Materials and methods
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) (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 onions are 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. Sampling techniques and analysis

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 multistage 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 agro ecological and geographical elevation of existing rice production farming system (upland and lowland rice-producing system) (Melese, Goshu, & Tilahun, 2018). Then the total of 12 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 low land stratum and one kebele from upland stratum and then to draw the sample respondents from each selected kebele. Accordingly, Woreta zuryi (109) & Quchar Michlae (111) were selected from lowland and Adis Betkristiyan (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.

As a result, a list of all smallholder farmers in the 2018/19 production year was compiled with the help of the extension workers and the heads of these three smallest administrative units. Then after study was conducted based on cross-sectional data that were collected from representative smallholder farmers and used both descriptive and analytical multiple linear regression were used to analyze the volume of onions marketed and also selected for its simplicity, practical because all sampled households producing onion participated in marketing applicability (Becker & Greene, 2001). Thus, it is important to check the presence of heteroscedasticity, multicollinearity and endogeneity problem before fitting important variables into the regression models for analysis, therefore the data free from such problems.
\[ Y = \beta_0 + \beta_i \sum X_i + U \]

where \( \beta_0 \) = an intercept

\( Y \) = volume of onion marketed supply (dependent variable)

\( X_i \) = independent variable, and

\( (I = 1, 2, 3 \ldots n) \)

\( \beta i \) = coefficients of \( i \)th, independent variable

\( U \) = Disturbance term/Error term.

3. Results

3.1. Sociodemographic characteristics of 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. In terms of marital status, most of onions producing sample households were married (90.2%), and the remaining were divorced (4.7%), widowed (3.6%) and single (1.5%). The educational background of the sample household head is believed to be an important feature that determines the readiness of household heads to accept new ideas and innovations. Farmers that are more educated are expected to adopt new technologies to increase their land and labor productivity. Based on the categorization of education, the data indicated that 41.45% of the respondents were illiterate and the remaining 58.55% attained formal education ranging from grade 1 to degree.

The mean age the of respondents were 43.76 years. Whereas, the maximum and the minimum household size were 12 and 1, respectively. The average household heads size for the surveyed households were 5.51. The average size of land allocated for onion was 0.340 ha with standard deviation of 0.176 ha.

3.2. Determinants of market supply of onion

Fourteen explanatory variables were included in the model to analyze the determinate factors for the onion market supply. Table 3 shows the sign, magnitude, statistical tests and significance level of each explanatory variable. Out of the 14 variables hypothesized to influence onion market supply eight variables were significantly affect onion market supply estimated using the multiple linear regression model (Table 1 and Table 2).

As expected, both Age and Sex of household head were positively and significantly at 5% and 10% significance level affected the amount of onion supplied, respectively (Table 3). Thus, a year increase in the age gives rise to 0.159 quintal of onion sold. The principle is that aged households have wider experience which helps them produce large and sell more. This finding consistent with the finding of (Asale et al., 2016) who found of age of household head positively and significant influencing marketed supply of onion, where as being a male head of a household significantly increase onion quantity supplied to the market by 2.719 quintals as compared to that of female-headed households, keeping other variables constant. This is consistent with the finding of (Mahlet, Bezabih, Mengistu, Jeffreyson, & Jemal, 2015) and (Giziew, 2019; Shafi, Zemedu, & Geta, 2014) who found that gender of the household head positively and significantly influenced on the volume potato and papaya marketed supply, respectively.

As expected, household size is significant at 5% significance level, i.e., The positive and significant relationship indicates that as onion production is labour intensive activity, larger household size provides higher labour to undertake onion production and management activities easily which
in turn increases marketable onion volume leading to increased capacity of onion market participation. Similarly (Somano, 2008) also revealed that family size is one of the factors that affect the probability of marketable supply of dairy milk positively and significantly in shashemane.

As hypothesized, area allocated to onion production and post-harvest value additions is significant and positive relation with the quantity of onion supplied to the market at 1% significance.

| Table 1. Definition and descriptive statistics of socioeconomics and demographic variables |
| Variables | Notation | Category/ Type | Code/ Measurement/ QoS |
| --- | --- | --- | --- |
| Sex of Household Head | MALE- HEAD | Dummy | 1 = Male, 0 = otherwise +ve |
| Age of household Head | AGEHH | Continuous | Years +ve |
| Household size | FMS | Continuous | Manequv +ve |
| Education status household head | EDHH | Dummy | 1 = literate, 0 = otherwise +ve |
| Livestock ownership | LIVH | Continuous | TLU +ve |
| Frequency of extension contact | EXTCNT | Discrete | Number of visits per year +ve |
| Motor Pump Ownership | Own-motor | Dummy | 1 if motor pump 0 otherwise +ve |
| Access to Credit take | ACCTCS | Dummy | 1 if accessible, 0 otherwise +ve |
| Marketing contract | MC | Dummy | 1 if contracted, otherwise 0 +ve |
| Distance to the nearest market | MRK_DIST | Continuous | Walking time in hours +ve |
| Agro ecology | Agro- Eco | Dummy | 0 if upland, 1 if lowland +ve |
| Area allocated for onion | Land-onion | Continuous | Hectare +ve |
| Market information | MRK_INFO | Dummy | 1 = has access to market information, 0 otherwise +ve |
| Post-harvest value addition | PHVA | Dummy | 1 = value addition and 0 otherwise +ve |

| Table 2. Descriptive statistics both categorical and continues variables |
| Variables | Category | Frequency | Percent |
| --- | --- | --- | --- |
| Sex of HH | Male | 218 | 79.27 |
| | Female | 57 | 20.73 |
| Education status | Literate | 161 | 58.55 |
| | Illiterate | 114 | 41.45 |
| Marital status | Married | 248 | 90.2 |
| | Single | 4 | 1.5 |
| | Divorced | 13 | 4.7 |
| | Widowed | 10 | 3.6 |

| Variable | Mean | Set.Dev | Min | Max |
| --- | --- | --- | --- | --- |
| Age | 43.76 | 9.75 | 22 | 78 |
| Household size | 5.51 | 1.98 | 1 | 12 |
| Land size Allocate to onion | 0.340 | 0.176 | 0.025 | 1.05 |
| Livestock ownership(TLU) | 8.72 | 2.67 | 4.2 | 19.5 |
level. This implies that those households allocated more land to onion production have managed to supply more product to the market. The coefficient shows an increase in the area allocated to onion production by one hectare would result in 33.350 quintal increase in the quantity of onion supplied to the market. Whereas farmers who have practiced post-harvest value addition (cutting, proper storage, grading, and cleaning) have increased by 8.383 quintals than those who not use value add. So they prefer to sell their produces with fair market price as yield of onion increase because of quality of onion which is mostly preferred. This result is congruent with the findings of previous studies (Haji & Alemu, 2012; Tola & Ketema, 2014).

Contract marketing and own motor pump are significantly and positively influences onion market at 1% significance level as hypothesized. This implies that producers have onion contract-marketing, the probability of production and participate it to onion market increase by 6.139 quintals than those who have not contract marketing. The reasons behind that most of farmers’ respondent were under contract and the ready market did absorb the whole products. The finding is in line with that of (Geoffrey, Bett, Kiprop, & Odipo, 2014; Obasi & Kalu, 2019) who found an increase in formal market participation with the availability of market contractual agreement amongst smallholder and emerging farmers in the Kat river valley, South Africa, on the other hand, Own motor pump is a vital farm input for onion growers in the study area and this implies that farmers who have own motor pump have increased by 11.588 quintals of onion production than those who have not own motor pump. According to the information obtained from the district office of agriculture, most of water pumps found in the study area were owned in share by two or three farmers. The group members’ watering schedule priority is done with an agreement. If all members of the group are not using of the water pump, they will rent the pump for others. For the time being the average rent of a water pump in the study area was birr 25 per hour. The major source of irrigation water is river. Moreover underground water and the lake shore water are used by some of the sample households even so, ownership of the water pump was assumed to have a positive effect on the production of onion production package.

### Table 3. Ordinary least square estimation results of Determinants of volume of onion marketed supply

| Variables                  | Coef.  | Robust Std. Err. | t- Value | P > t |
|----------------------------|--------|------------------|----------|-------|
| Sex of HH                  | 2.719* | 1.379            | 1.97     | 0.050 |
| Age of HH                  | 0.159**| 0.062            | 2.57     | 0.011 |
| Educational status of HH   | 0.501  | 1.311            | 0.38     | 0.702 |
| Household size             | 0.925**| 0.392            | 2.36     | 0.019 |
| Livestock ownership        | 0.240  | 0.266            | 0.90     | 0.368 |
| Land size for onion        | 33.350***| 4.636         | 7.19     | 0.000 |
| Own motor pump             | 11.588***| 1.318          | 8.79     | 0.000 |
| Market contract            | 6.139***| 1.744            | 3.52     | 0.001 |
| Post-harvest value addition| 8.383***| 1.577            | 5.32     | 0.000 |
| Market Information         | 4.331**| 1.752            | 2.47     | 0.014 |
| Extension contact          | -0.026 | 0.056            | -0.47    | 0.637 |
| Credit take                | 2.467  | 1.757            | 1.40     | 0.161 |
| Distance to the local market| 0.010   | 0.043            | 0.23     | 0.816 |
| _cons                      | -16.107***| 5.056          | -3.19    | 0.002 |

*** ** and * Significant at P < 0.01, 0.05 & p < 0.1, respectively
The other determinate factors access to market information is positively and significant at 5% significance level. The coefficient also confirmed that accessing market information to farmers would tend to increase the marketable supply of onion by 4.331 quintals. The implication is that obtaining and verifying information helps to supply more quantity of onion. This result is consistent with the finding (Urgessa, 2011) and (Mateows, WoldeAmanuel, & Asfaw, 2015) also revealed that access to market information of the household head is that affect the probability of marketable supply of teff and agro-forestry products in the case of fruit positively in Halaba special Woreda and Tembaro, respectively.

4. Conclusion and policy implication
The study has given a due emphasis mainly for determinates affecting the volume of onion supply to markets. The data were formed mainly via interview and discussion using a pre-tested semi-structured schedule and checklists. Personal observations and prior knowledge of the areas have helped a lot in investigating the markets. Moreover, secondary data from the woredas Office of Agriculture have supplemented much to further investigate onion markets. The study investigated the determinants of onion supply by using the Multiple Linear Regression Model. The result indicates that both demographic, socioeconomics and marketing factors affecting onion producer households positively in the study area. So, there is a need to enhance value addition activities to improve the quality of onion in order to fetch higher price and to choose the more lucrative market outlet, enables them to link up with crops output market. Even it provided in line with current fruit and vegetable production development policies of the country. This could be done by designing appropriate capacity-building program to train producers and additional development agents to reduce the existing high degree perishability for male head households by improving, facilitating and giving priority for increasing production and market supply. Future intervention there should increase the volume of onion-marketed supply which leads to rise in their participation in the domestic and international market those positive and significant variables might to be implement through symmetric market information. Subsequently, decision makers, woreda agriculture office experts and onion producers should give special attention to decision makers, and also significant explanatory variables to increase the quantity of onion supplied to the market.

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