Econometric analysis of factors affecting market outlet choice of mango fruit producers in Hadero Tunto Zuriya District, Southern Ethiopia

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Abstract: The perishability nature of mango fruit necessitates an effective marketing outlet choice decision. But, selecting the appropriate market outlet is not easy task because different constraints affect producers to select the relevant outlet. Thus, this study was undertaken to identify factors affecting mango fruit market outlet choices in Hadero Tunto Zuriya District, Ethiopia. Combinations of purposive and random sampling techniques were employed, to select 150 mango producers in the study area. Multivariate Probit model (MVP) was used to analyze the determinant factors that affect the choices of market outlet of smallholder mango producers. In the study area local collectors, wholesalers, retailers and direct consumers marketing outlets were used by mango producers. MVP model result revealed that distance to the nearest district market and quantity produced had a positive association for the probability to choose the local collector market outlet whereas, current market price a negative association. The probability to choose wholesaler outlet was positively influenced by quantity of mango fruit produced. Market price, own transport access and market information had positive association for consumer market outlet, whereas non/off-farm income access and amount of quantity produced were negatively affected the probability to choose the retailer outlet. Therefore, this implies that the need to invest on improving the

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PUBLIC INTEREST STATEMENT
Horticultural crops in general and mango fruit crop in particular are grown in Ethiopia under rain-fed and/or irrigation system. Perishable nature of mango fruits requires ready and organized market outlet. Not only boosting the production but also selecting the right market outlet is essential for smallholder mango producers to generate attractive profit from their produce and enhance their living standard. Although the fruit has a great role on human nutrition, health, farm income generation and poverty alleviation, the current level of mango production and marketing is not at its optimum level due to immense internal and external factors. Therefore, the author is highly motivated to recommend a collaborated work between the government, market actors and farm households to encourage this product.
present infrastructure like roads, transportation facilities and market information delivery system are vital area of intervention that would assist smallholder farmers to choose the more rewarding market outlet.

**Subjects: Agriculture & Environmental Sciences; Food Additives & Ingredients; Economics and Development**

**Keywords: Mango; market outlet choice; multivariate probit model**

1. **Introduction**

Mango (*Mangifera indica* L.) also called “the king of fruits”, is one of the most widely cultivated and globally traded tropical and subtropical fruit trees in the world. It is the dominant tropical fruit variety produced worldwide, followed by pineapples, papaya and avocado. Total production of mango accounted for more than half of total global major tropical fruit production (FAO(Food and Agricultural Organization of United Nations), 2017). Currently, total world production of mangoes is about 48.7 million tons (MT) which played an integral part in the lives of many, not only by being a rich nutrient source but also as a source of livelihood for millions of peoples in the tropics (Mitra, 2014). On the demand side, changing consumer preferences in developed country markets continued to be the predominant factor fueling the expansion in global markets. Particularly in the United States of America and the European Union, the two largest import markets, increasing health consciousness and more widespread awareness of the nutritional benefits of tropical fruits are contributing to fast-growing consumption (FAO(Food and Agricultural Organization of United Nations), 2017).

Mango fruits are an excellent source of dietary antioxidants, such as ascorbic acid, carotenoids, and especially phenolic compounds (Ma et al., 2011). In addition to their medicinal and economic importance, they are perennial trees and can live more than 50 years that make them environmentally friendly to fight against drought, use as shade, fire wood, food security and agro industry.

Now a day, mango is one of the most widely cultivated and traded fruit crop in Ethiopia. According to CSA (2015) cropping season mango contributed about 14.09% of the area of land allocated for fruit production and holds 12.8% of quintals of fruits produced in the country. Accordingly, mango ranked 2**nd** and 3**rd** in total production and area coverage among fruit crops grown in Ethiopia, respectively.

Southern Nations and Nationalities Peoples Regional State (SNNPRS) have diverse agro ecology and many areas are suitable for growing temperate, subtropical or tropical fruits. The region solely covers about 41.89% of the mango production produced throughout the country (CSA, 2015). Hadero Tunto Zuria district has a suitable agro-climatic condition for production of different horticultural crops including mango, avocado, banana, ginger, coffee, sweet potato and taro. There are ample garden mango trees in the study area at farmer’s holdings. The livelihood of most of these farmers is highly supplemented by the sale of mango fruits and other horticultural products.

A review of literature in agro-industry value chain in Ethiopia indicated that the sub-sector faces many challenges due to limited market outlets, limited efforts in market linkage activities and poor market information among actors (Dereje, 2007; Getachew et al., 2009; Kaleb, 2008).

Like other fruits, mango is produced and supplied for different market outlets mainly local collector, wholesaler, retailer and direct consumer market outlets. In spite of different challenges for outlet choices of the producers; producers might select different outlets simultaneously among the existing market channels to maximize expected utility. In this study, the available choice was not mutually exclusive and respondents were expected to select different outlets simultaneously among the alternatives. Although farmers sold mango through different
market outlets, to the best of author knowledge so far no similar research has been done on status of factors affecting market outlet choice of mango producers in the study area. Thus, results of this study is very crucial in terms of providing very important information on the choice of appropriate market outlets through analyzing determinants of mango producer market outlet choice decisions thereby enable them to get reasonable profit in Hadero Tunto Zuriya district.

Therefore, this study tried to address households’ decision to choose market outlet for mango fruit marketing by addressing the following specific objectives to:

- Describe the socio-economic and institutional factors of mango producers and;
- Estimate determinants of smallholder farmers’ choice of mango fruit market outlet.

2. Research methodology

2.1. Study area
The study was carried out in Hadero Tunto Zuriya district of Kembata Tembaro Zone, Southern Ethiopia. The district is situated in North central part of Southern Nations Nationalities and People’s Regional State (SNNPR), Kembata Tembaro Zone. The district is located 291 Km South of Addis Ababa via Hossana and 380 Km via Shashamene. Geographically, the district lies between 7°6’40” N & 7°18’20”N; and 37°24’15”E & 37°48’18”E longitude. There are 18 kebeles in the district of which 16 are rural kebeles and 2 are urban kebeles. The district is bordered in the South by the Wolayita Zone, in the West by Tembaro district, in the North by the Hodiya Zone, and in the East by KachaBira district. According to annual report of the district in 2017, the total population for this District is 127,895 of whom 64,203 were men and 63,692 were women; 23,539 or 23.93% of its population were urban dwellers.

The district covers a total area of 18,650 hectares. The area experiences “daga” (12%), “woina-dega” (87%) and “Kola” (1%) climates (HTZDoA(Hadero Tunto Zuriya District Office of Agriculture), 2017). Agriculture is the main source of income of the population in the district. The area has a suitable agro-climatic condition for production of different horticultural crops including mango, avocado, banana, ginger, coffee, sweet potato and taro.

2.2. Data types and methods of data collection
For this study, both primary and secondary data were used. Survey was undertaken through formal interviews with randomly selected mango producer farmers using pre-tested semi-structured questionnaires. Secondary data was obtained from Central Statistical Authority (CSA), published and unpublished reports.

2.3. Sampling techniques and sample size determination
To draw sample for this study, combinations of purposive and random sampling techniques were employed to select mango producer kebeles and sample farm households (Table 1 and Table 2). Hadero Tunto Zuriya district was selected purposively based on the potential it has for mango production in the zone. Following the study area selection, a two-stage random sampling technique was then applied to select sample households. In the first stage, from mango-producing kebeles, 3 kebeles were randomly selected. In the second stage, 150 mango-producing household heads were selected from three kebeles using systematic random sampling technique. The sample size in each kebele was determined using probability proportional to size of the identified mango producers. The required sample size was determined by (Cochran, 1977) proportionate to size sampling methodology.

\[
n = \frac{z^2pq}{e^2}
\]  

(2.1)
Table 1. Sample distribution of households in selected kebeles

| No | Name of Kebele | Mango producer households | Sample households |
|----|----------------|---------------------------|-------------------|
| 1. | Ajora          | 710                       | 48                |
| 2. | Mandoye        | 771                       | 53                |
| 3. | 1 Tunito       | 722                       | 49                |
| 4. | Total          | 2203                      | 150               |

Source: Hadero Tunto Zuriya district office of agriculture and own design (HTZDoA(Hadero Tunto Zuriya District Office of Agriculture), 2017)

Table 2. Summary of hypothesized variable that determines mango producers' market outlet

| Variable name | Measurement | Collectors | wholesalers | retailers | consumers |
|---------------|-------------|------------|-------------|-----------|-----------|
| Age of Household head | Continuous (No of years) | +          | +           | -         | -         |
| Gender of Household Head | Dummy(1 for Male, 0 Otherwise) | +          | +           | -         | -         |
| Education     | Continuous (Years of schooling) | -          | +           | +         | +         |
| Family size   | Continuous (Adult equivalence) | -          | +           | +         | +         |
| Selling price in 2017/18 | Continuous (Price in bir per quintal) | -          | -           | +         | +         |
| Access to extension | Continuous (Frequency of contact) | -          | +           | +         | +         |
| Distance to market | Continuous (Km) | +          | +           | -         | -         |
| Access to credit | Dummy (1 has access, 0 otherwise) | -          | +           | +         | +         |
| Access to market information | Dummy (1 has access, 0 otherwise) | -          | +           | +         | +         |
| Quantity of mango produced | Continuous (Quintal) | +          | +           | -         | -         |
| Ownership of Market Transport Facilities | Dummy (1 has access, 0 otherwise) | -          | -           | +         | +         |
| Access to non/off-farm activities | Dummy (1 has access, 0 otherwise) | -          | +           | +         | +         |
| Number of mango trees | Continuous (Number) | +          | +           | -         | -         |

Note: +ve/-ve either negatively or positively affects the likelihood channel choice.
Where; \( n \) = Sample size; \( Z \) = confidence level (\( \alpha = 0.05 \)); \( p \) = proportion of the population containing the major interest, \( q = 1-p \) and \( e \) = allowable error (0.08). Hence, \( Z = 1.96 \).

2.4. Method of data analysis

Both descriptive statistics and econometric analysis were used to meet the specific objectives of this study. In descriptive statistics mean, standard deviations, frequency and percentage were used to describe the hypothesized variables. Whilst for econometric analysis multivariate probit model (MVP) model was used.

Multinomial models are appropriate when individuals can choose only one outcome from among set of mutually exclusive, collectively exhaustive alternatives (Gumataw et al., 2016). However, in this study producers’ market outlet, choices are not mutually exclusive; considering the possibility of simultaneous choices of outlet and the potential correlations among these market outlet choice decisions. Since the market outlet choice decision is inherently multivariate, attempting univariate modeling excludes useful economic information contained in interdependent and simultaneous choice decisions (Dorfman, 1996). Therefore, this paper employs MVP. The MVP technique simultaneously models the influence of the set of explanatory variables on each of the different market outlet choices while allowing for the potential correlation between unobserved disturbances, as well as the relationship between the market outlet of different practices (Belderbos et al., 2004). One source of correlation may be complementarity (positive correlation) or substitutability (negative correlation) between different choice (Belderbos et al., 2004). Positive correlation also occurs if there are unobservable farmer-specific characteristics that affect several decisions but that are not easily captured by measurable proxies. Failure to capture unobserved factors and interrelationships among choice decisions regarding different practices will lead to bias and inefficient estimates (Greene, 2008).

It is assumed that a given producer \( i \) in decision making considering not exclusive alternative that constituted the choice set \( K \)th of mango marketing outlets, the choice sets may differ according to the decision maker for maximizing his/her utility and profit. Let \( U_0 \) represent the benefits to the farmer who chooses local collectors, and let \( U_k \) represent the benefit of farmer to choose the \( K \)th market outlet: where \( K \) denotes choice of local collector \( (Y_1) \), wholesalers \( (Y_2) \), retailers \( (Y_3) \) and consumers \( (Y_4) \). The farmer decides to choose the \( K \)th market outlet if \( Y_k = U_k - U_0 > 0 \). The net benefit \( Y_{ik} \) that the farmer derives from choosing a market outlet is a latent variable determined by observed explanatory variable \( Z \) and the error term \( e_k \):

\[
Y_{ik} = Z\beta + e_k = (Y_1, Y_2, Y_3, Y_4)
\]

Using the indicator function, the unobserved preferences in the above equation translate into the observed binary outcome equation for each choice as follows:

\[
\begin{cases}
1 & \text{if } Y_{ik} > 0 \\
0 & \text{Otherwise}
\end{cases} \quad (K = (Y_1, Y_2, Y_3, Y_4))
\]

In multivariate model, where the choice of several market outlets is possible, the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity (for identification of the parameters) where \((\mu_{x1}, \mu_{x2}, \mu_{x3}, \mu_{x4})\text{MVN}(0, \Omega)\) and the symmetric covariance matrix \( \Omega \) is given by:

\[
\Omega = \begin{bmatrix}
1 & \rho_{12} & \rho_{13} & \rho_{14} \\
\rho_{21} & 1 & \rho_{23} & \rho_{24} \\
\rho_{31} & \rho_{32} & 1 & \rho_{34} \\
\rho_{41} & \rho_{42} & \rho_{43} & 1
\end{bmatrix}
\]

Of particular interest are the off-diagonal elements in the covariance matrix, which represent the unobserved correlation between the stochastic components of the different types of outlets. This assumption means that Eq. (2.4) generates a MVP model that jointly represents 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 formula used by Cappellari and Jenkins (2003), the log-likelihood function associated with a sample outcome is then given by:

\[ \ln L = \sum_{i=1}^{N} \omega_i \ln p(y_i | \mu, \Omega) \]  

(2.5)

Where \( \omega \) is an optional weight for observation \( i \) and \( \Phi_i \) is the multivariate standard normal distribution with arguments \( \mu_i \) and \( \Omega_i \), where \( \mu_i \) can be denoted as:

\[ \mu_i = (\alpha_1/X_1, \alpha_2/X_2, \alpha_3/X_3, \alpha_4/X_4) \]  

While \( \Omega_k = \sum_{j=1}^{k} \Omega_{kj} \) for \( j = k \) and \( \Omega_{jk} = \Omega_{kj} = \sum_{k=1}^{3} \Omega_{ik} \) for \( j \neq k ; k = 1, 2, 3 \). 

### 3.1. Results and Discussion

#### 3.1. Demographic and socioeconomic characteristics of sampled respondents

The descriptive statistics of the variables that were used in this study are presented in this section. From the collected sample data, descriptive statistics of the household characteristics, socioeconomic and institutional variables that were believed to influence decision making were assessed and the following results were obtained. The mean household characteristics by mango market outlets are provided in (Table 3).

The average age of the respondents, which had access to the local collector, wholesaler, retailer and consumer mango market outlets were 44, 43, 43 and 42, respectively. Similarly, the mean household size in adult equivalency which had access to the local collector, wholesaler, retailer and consumer mango market outlets were 3.1, 3.1, 2.9 and 3 per mango product, respectively. Regarding to educational status of the respondents who sold to the wholesaler (6) outlet had relatively better educational status than others who sold their mango fruit mainly through local collectors (4), retailers (5) and consumers (5) market outlets. The average market distance for

| Table 3. Mean (std) household characteristics by mango market outlets |
|---------------------------------------------------------------|
| **Variable**                | **Local collectors** | **Wholesalers** | **Retailers** | **Consumers** |
| Age of HH head             | 44(9)               | 43(9)           | 43(11)        | 42(9)        |
| Family size (Adult equivalency) | 3.1(1)               | 3.1(0.9)        | 2.9(1)        | 3(1)         |
| Education in years of schooling | 4(4)                | 6(4)            | 5(3)          | 5(3)         |
| Experience (years)         | 14(6)               | 14(7)           | 13(6)         | 14(7)        |
| Distance from nearest market(km) | 5.2(1.8)             | 4.3(2.5)        | 3.9(2.1)      | 3.7(2)       |
| Selling price of mango birr per Qt | 202(70)              | 263(80)         | 276(77)       | 304(67)      |
| Quantity produced (Qt)     | 32(15)              | 41(14)          | 22(11)        | 26(14)       |
| Quantity supplied (Qt)     | 23(12)              | 31(12)          | 16(9)         | 21(11)       |
| Number of mango tress       | 12.56(5.72)         | 13.96(7.12)     | 14.31(6.09)   | 15.62(6.85)  |

Source: Own survey (2017/18).
Table 4. Proportion of household characteristics by mango market outlets

| Variable                     | Category           | Local collectors(%) | Wholesalers (%) | Retailers(%) | Consumers (%) |
|------------------------------|--------------------|---------------------|-----------------|-------------|---------------|
| Gender HH                    | Female             | 16.2                | 12.5            | 18.2        | 17.1          |
|                              | Male               | 83.8                | 87.5            | 81.8        | 82.7          |
| Non/off farm participation   | No                 | 89.7                | 66.7            | 84.1        | 76.9          |
|                              | Yes                | 10.3                | 33.3            | 15.9        | 23.1          |
| Access to extension service  | No                 | 76.5                | 62.5            | 53.4        | 51.9          |
|                              | Yes                | 23.5                | 37.5            | 46.6        | 48.1          |
| Access to credit             | No                 | 66.2                | 43.8            | 53.4        | 40.4          |
|                              | Yes                | 33.8                | 56.2            | 46.6        | 59.6          |
| Own transport facility       | No                 | 80.9                | 56.2            | 60.2        | 44.2          |
|                              | Yes                | 19.1                | 43.8            | 39.8        | 55.8          |
| Access to market information | No                 | 69.1                | 45.8            | 47.7        | 28.8          |
|                              | Yes                | 30.9                | 54.2            | 52.3        | 71.2          |

Source: Own survey (2017/18).

mango producers who sold mainly to the consumer market outlet was on average 3.7 km away from the nearest market while those sold for local collector (5.2 km), wholesalers (4.3 km), and retailers market outlet (3.9 km) away from their home. The average proportion of mango production of household characteristics by mango market outlets accessed by the local collector, wholesaler, retailer and consumer market outlet was 32, 41, 22 and 26 quintals of mango per hectare was accessed, respectively.

According to the results in (Table Table 4) both male and female-headed households’ are engaged in production and marketing of mango. Out of the 150 respondents that participate in mango production, the majorities (83.3%) were male-headed and the remaining (16.7%) were female-headed. The proportion of male household-headed respondents sold (83.8%) to the local collector (87.5%) to wholesaler (81.8%) to retailer and (82.7%) consumers market outlets. The results further portrayed that female-headed household choice retailer and consumer outlet markets more than local collector and wholesaler markets.

The availability of well-functioning transport network is very important because it creates place utility of the product. The results on own transport facility indicate that 19.1%, 43.8%, 39.8% and 55.8% of market participants sold mango to local collector, wholesaler, retailer and consumer, respectively, as the choice of marketing outlets. In terms of households who have non/off farm activities, 10.3, 33.3, 15.9 and 23.1% mango producers sold their product to the corresponding local collector, wholesaler, retailer and consumer market outlet which involved in mango trading activities.

Closer look at access to market information depicted; as there was no system in place that systematically collect, analyze and disseminate information relevant to the needs of different actors. Access to timely and accurate market information is the basic element not only in mango market but also in other commodity marketing. For farmers, knowing where and when to sell their output is one of the most difficult challenges. If they have no knowledge of current market prices, they can easily be exploited. But gathering current information about markets may not be easy, especially for people living in very remote areas. Market information facilitates the supply of the produce timely and selection of appropriate outlets. Accordingly, the results for household heads that have access to market information portray that 30.9%, 54.2%,
52.3% and 71.2% sold their mango to local collector, wholesaler, retailer and consumer, respectively.

Even though three development agents institutionally assigned to work in crop production, animal rearing and natural resource conservation in each kebele, the extension service is hardly delivered on improving mango production and marketing in the study area.

3.2. Market outlet choice pattern of sample households

The alternative market outlets available to mango producers in the study area include local collectors, wholesalers, retailers and consumers. These outlets are mostly chosen in combination with one another. As depicted in (Table 5) one of the most commonly used market outlets by producers is the retailer outlet which was chosen by about 58.67% respondents with mean supply of 16 quintal, while about 45.33% % of respondents sold to local collectors with mean supply of 23 quintal. As consumers are also common mango marketing outlet in the study area, around 34.67% of sample households sold to the consumers with mean supply of 21 quintal. From the total sampled households, 32% of them choose wholesalers as mango marketing outlet with mean supply of 31 quintal. Based on this result, even though mango producer’s tend to choice consumers and retailer’s market outlet channels, still bulk of mango production flows in local collectors and wholesalers market outlets.

3.3. Factors affecting smallholder mango producers market outlet choices

Farmers who produce mango in Hadero and Tunto Zuriya have four alternative market outlet channels for selling Mango. These are local collectors, wholesalers, retailers and consumers. Multivariate probit was used to analyze the mango 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 (Wald $\chi^2 (52) = 154.15$, $p = 0.000$) is significant at 1%, 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. The MVP model fits the data reasonably well. The result of likelihood ratio test in the model (LR $\chi^2 (6) = 32.854$, $\chi^2 = 0.000$) is statistically significant at 1% level, indicating that the null hypothesis that the independence between market outlets choice decision ($\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$) is rejected at 1% significance level and there are significant joint correlations for two estimated coefficients across the equation in the model (Table 6). This verifies that separate estimation of choice decision of these outlets is biased and the decisions to choose the four mango market outlets are interdependent households’ decision.

| Decision                          | Market outlet choices of mango producers |
|-----------------------------------|----------------------------------------|
|                                   | Local Collectors | Wholesalers | Retailers | Consumers |
| Freq. | % | Freq. | % | Freq. | % | Freq. | % |
|---|---|---|---|---|---|---|---|
| Yes | 68 | 45.33 | 48 | 32.00 | 88 | 58.67 | 52 | 34.67 |
| No | 82 | 54.67 | 102 | 68.00 | 62 | 41.33 | 98 | 65.33 |

Supplementary Table 5: Description of mango market outlets

| Decision                          | Market outlet choices of mango producers |
|-----------------------------------|----------------------------------------|
|                                   | Local Collectors | Wholesalers | Retailers | Consumers |
| Freq. | % | Freq. | % | Freq. | % | Freq. | % |
|---|---|---|---|---|---|---|---|
| Yes | 68 | 45.33 | 48 | 32.00 | 88 | 58.67 | 52 | 34.67 |
| No | 82 | 54.67 | 102 | 68.00 | 62 | 41.33 | 98 | 65.33 |

Source: Own survey results, 2017/18
### Table 6. Overall fitness, probabilities and correlation matrix of market outlets from the MVP model

| Variables                  | Local collector | Wholesaler | Retailer | Consumer |
|----------------------------|-----------------|------------|----------|----------|
| Predicted probability      | 0.461           | 0.323      | 0.599    | 0.333    |
| Joint probability (success) |                 | 0.007      |          |          |
| Joint probability (failure) |                 |            | 0.042    |          |
| Number of draws            |                 |            |          | 5        |
| Observation                |                 |            |          | 150      |
| Log likelihood             |                 |            |          | -232.18728 |
| Wald χ² (52)               |                 |            |          | 154.15   |
| Prob > χ²                  |                 |            |          | 0.0000*** |

|     | ρ₁    | ρ₂    | ρ₃    | ρ₄    |
|-----|-------|-------|-------|-------|
| ρ₁  | 1     |       |       |       |
| ρ₂  | -0.722*** (.149) | 1     |       |       |
| ρ₃  | -0.395** (1.176) | -0.096 (1.181) | 1     |       |
| ρ₄  | -0.099(1.188) | -0.132 (1.178) | 0.485*** | 1     |

Likelihood ratio test of ρ₂₁ = ρ₂₁ = ρ₂₁ = ρ₂₁ = ρ₂₁ = 0

χ²(6) = 32.85x3

Prob > χ² = 0.0000

*** and ** indicate statistical significance at 1 and 5, respectively. ρ₁ = local collector, ρ₂ = wholesaler, ρ₃ = retailer and ρ₄ = consumers, Parenthesis in the disturbance term correlation matrix showed the standard error (SE). Source: Own computation from survey result (2017/18)

There are differences in market outlet selection behavior among producers, which are reflected in the likelihood ratio statistics of estimated correlation matrix. Separately considered, the ρ values (ρ₂₁) indicate the degree of correlation between each pair of dependent variables. The ρ₂₁ (correlation between the choice for local collector and wholesaler), ρ₃₁ (correlation between the choice for retailer and local collector outlet) were negatively interdependent and significant at the 1 and 5% probability levels. This finding leads us to the conclusion that mango producers delivering to the local collectors outlet are less likely to deliver to wholesalers (ρ₂₁). Equally, those involved in retailer market outlet are less likely to send their mango fruit to collectors’ outlet (ρ₃₁). Hence, the result indicates competitive (substitutable) relationship of local collector with wholesaler and retailer outlet. On the other hand, ρ₃₂ (correlation between the choice for retailer and consumer) was positively interdependent and significant at 1% probability level. Thus, the result indicates complementary relationship of retailer with consumer outlet (Table 6).

The simulated maximum likelihood (SML) estimation result shows that the probability that mango producers choose collector, wholesaler, retailer and consumer market outlets were 46, 32.3, 59.9, and 33.3%, respectively. This indicates the likelihood of choosing wholesaler and consumer outlets is relatively low as compared to the probability of choosing local collector and retailer outlets. If mango farmers chose all four market outlets, their joint probabilities of choosing these market outlets would be only 0.7%. It was unlikely for farmers to choose all four market outlets simultaneously. This was justified either by the fact that simultaneous selection of all market outlets was unaffordable for the smallholders mango farmers, or that all four market outlets were not simultaneously accessible in the study areas. However, their joint probability of not choosing all four market outlets was 4.29%, implying that the households were more likely to fail. This evidence suggests that choosing the right mix of market outlet is determined by different factors, including market access, infrastructure availability, and consumer demand.
factors for each market outlets. The finding was also consistent with Melese et al. (2018) in their study on determinants of outlet choices by smallholder onion farmers in Ethiopia.

Based on result of MVP model in (Table Table 7), some of the variables were significant at more than one market outlet while one variable was significant in only one market outlet. Out of thirteen explanatory variables included in the model, four variables affected significantly local collector market outlet; one variable significantly affected wholesaler outlet; three variables significantly affected retailer outlet, and three variables significantly affected consumer market outlet choice at different probability levels.

**Quantity of mango produced:** It determined the probability of choosing retailer market outlet negatively, but wholesaler and collector market outlets positively at less than 1% and 10% level of significance. The negative correlation in the case of quantity of mango produced implies that farmers who produce a large volume of mango prefer wholesaler or collector market outlet than retail as retailers purchase a small quantity of mango. This is because the collectors and wholesalers have the capacity to purchase large quantity of mango fruit. The implication is that if the quantity of mango fruit to be sold is large, producers search market outlets that buy large volume; this is because of perishable nature of the fruit. This finding is in line with the results of Muthini (2015), Emana et al. (2015), and Atsbaa (2015).

**Distance to the nearest market:** Distance from the market is positively associated with likelihood of producers selling to local collectors at 5% level of significance. It reflects that household located far away from the nearest market center faces difficulty in delivering mango fruit to other market outlets due to poor road facility to sell their product. Hence, they sold to available market outlets in their locality. The positive relation of distance and likelihood of choosing collector was due to the fact that local collectors have collection centers in each kebeles/nearby kebeles to collect mango fruit at farm gate that reduces the transportation cost of producers. Moreover, collectors purchase mango fruit at farm gate from producers by going door to door and sometimes bargaining the price even before the fruit picking from the tree during the harvesting season. This implied that with the increase in distance to market, producers preferred to sell to collectors rather

### Table 7. Multivariate probit estimations for determinates of mango fruit producers outlet

| Variables | Collectors | Wholesalers | Retailers | Consumers |
|-----------|------------|-------------|-----------|-----------|
|           | Coef.(Std. Err.) | Coef.(Std. Err.) | Coef.(Std. Err.) | Coef.(Std. Err.) |
| _IGender_1 | -0.232 (0.147) | 0.44 (0.363) | -0.364 (0.318) | 0.068 (0.336) |
| Age       | -0.023 (0.023) | -0.007 (0.019) | 0.002 (0.018) | -0.012 (0.017) |
| Familysize| 0.573*** (0.178) | 0.097 (0.132) | -0.214 (0.132) | -0.065 (0.124) |
| Heduc     | -0.051 (0.053) | 0.072 (0.049) | -0.0159 (0.045) | -0.027 (0.044) |
| Experience | 0.010 (0.031) | 0.007 (0.024) | 0.015 (0.022) | 0.010 (0.022) |
| DMkt      | 0.148** (0.067) | -0.036 (0.060) | -0.075 (0.057) | -0.049 (0.057) |
| INOFI_1   | -0.326 (0.450) | 0.361 (0.386) | -0.749* (0.387) | -0.167(0.345) |
| Price     | -0.017*** (0.003) | -0.0004 (0.002) | 0.0005 (0.0018) | 0.0038** (0.0018) |
| Aextension| -0.454 (0.337) | -0.200 (0.295) | 0.185 (0.271) | -0.319 (0.259) |
| Otran     | -0.025 (0.372) | 0.425 (0.320) | 0.972*** (0.329) | 0.857*** (0.274) |
| Qproduced | 0.078* (0.014) | 0.0772*** (0.0141) | -0.058*** (0.010) | -0.0047 (0.0085) |
| JMLInfo_1 | -0.338 (0.332) | 0.425 (0.292) | -0.005 (0.280) | 0.681** (0.257) |
| Ntrees    | 0.003 (0.024) | 0.028 (0.021) | -0.009 (0.019) | 0.014 (0.019) |
| _cons     | 3.537 (1.428) | -4.059*** (1.251) | 2.954 (1.071) | -1.227 (1.088) |

***, ** and * indicate statistical significance at 1, 5 and 10, respectively. Own computation from survey result, (2017/18)
than selling to other market outlets that associated with incurring higher transportation costs. This result confirms the finding of Abera (2016), Tarekegn et al. (2017), and Atsbaha (2015) that showed distance to nearest market was negatively and significantly related to the channel choice of retailers' outlet.

**Market information:** Access to market information is also positively and significantly associated with the likelihood of choosing consumer outlets at 1% level of significance. Access to current market information improves producers’ selling price, because market information helps producers to analyze the price difference in their locality and the nearby main market that increases probability of choosing consumers which give relatively higher price to producers. The implication is that households prefer to sell for the final user (consumer) as they start accessing to market information regarding with price, demand, availability of traders’ transport cost and other related information. The finding is inline with Emama et al. (2015) that market information has a positive and significant effect on retailer channel choice decision of potato producers, but contrary to Geoffrey et al. (2014) and Adugna et al. (2019) indicated that those farmers getting price information are less likely to sell at urban market perhaps to avoid high transaction cost at distant market.

**Family Size:** The family size of household was positively influencing the local collector market outlet choice of mango producers. This implied that large family size helps the farmers to sell their mango produced to local collectors. This may be due to producers in the study area mainly engaged on labour intensive farm activities rather than fruit marketing. This finding is contrary with the Honja et al. (2017) who indicated that large family size enables better labor endowment so that households are in a position to travel to get wholesalers in the district or nearby town markets.

**Non/off farm income:** Non/off farm income affect the probability of choosing retailer market outlet negatively at 10% levels of significance. Farmers who are involved in off/non-farm activities are less likely to send their mango to retailer outlet as compared to mango farmers who didn’t participated in off/non-farm income activates. The possible explanation is that as the farmer involved in non/off farm activities the time he/she has to spare for marketing of agricultural activities and to produce marketable surplus is less, hence this decreases the probability of participating in retailer market channel. This result is consistent with Tefera and Tefera (2014) and Melese et al. (2018) who found that non/off farm activities engagement have negative effect on retailer market outlet participation.

**Current market price:** Market price affect the probability of selecting consumer market outlet positively at 5% level of significance and affect local collector market outlet negatively at 1% level of significance. According to the result, producers may obtain maximum price per their supply to final consumer than other market outlets. This finding concurs with Temesgen et al. (2017) stated that the market price of sesame has a positive and significant effects on consumer’s market outlet choice whereas a negative and significant effect on collector outlet choice.

**Ownership of transport assets:** ownership of transport influenced the choice of retailer and consumer outlet positively and significantly at 1% level of significance. This might be farmers who have transport facility that could supply their product to local market centers and sell to retailers and consumers directly by obtaining better price. The result concurs with the argument of Melese et al. (2018) who stated that the availability of on-farm transport increases the probability of transporting goods to private traders and retailers in the market.

4. **Conclusion and implications**

The study was conducted in Southern Ethiopia to identify factors that affect market outlet choice decision of mango fruit producers. In order to undertake this research, combinations of purposive and random sampling techniques were employed to select 150 mango producers and analyzed using the descriptive and multivariate probit models. Factors affecting mango fruit market outlets
choice were analyzed by Multivariate probit model. The result indicated that the outlet choice of local collector was negatively and significantly influenced by current market price and positively influenced by family size, distance to the nearest district market and amount of quantity produced with 46% predicted probability of marginal success. Wholesalers market outlet was positively and significantly affected by quantity of mango produced with 32% predicted probability of marginal success. Whereas retailers’ outlet was positively and significantly affected by availability of own transport access and negatively and significantly affected by access to non/off-farm income and quantity of mango produced with 59.9% predicted probability of marginal success. On the other hand, direct consumers outlet was positively and significantly affected by current market price, own transport access and market information with 33.3% predicted probability of marginal success.

Based on the findings of this study, some relevant implications can be drawn that can assist to design appropriate intervention mechanisms to improve market outlets choice of mango fruit farmers in the study area. Interventions intended at reducing transaction costs through rural infrastructure investment in the form of improving the quality of feeder roads which connect rural remote areas with main market road, formation of mango producer unions and cooperatives, improving market information delivery system to avoid information asymmetry, creating awareness to male mango producers to participate in retailer and consumer market outlets are vital area of intervention that would assist farmers to choose the more rewarding market outlets. Hence, to promote the flow of mango product from producers to the ultimate consumers through different outlets, the producer’s knowledge and skill on marketing and production should be improved through training, mass media and redesign, strengthening and developing implementation strategies on extension education.

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