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# Determinants of Beekeepers Participation Decision and Level of Participation on Honey Value Addition: In Case of Masha Woreda Sheka Zone, Southwestern Ethiopia

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**Abstract**
This study aimed at identifying determinants of the beekeepers participation decision and extent of participation on honey value addition. The primary data for this study were collected from 147 beekeepers and analyzed using application of appropriate statistical tools. The Tobit model result indicates that the value addition decision and extent is significantly affected by perception of beekeepers towards price of value added honey, cooperative membership of the HH head, HH adult equivalent, extension service, credit access, and distance to the nearest market and education level of the HH head. Therefore, policies promoting farmers access to modern beekeeping technologies, improving extension service, credit and market information access, gender consideration and cooperative development are recommended to improve honey value chain in the study area.
**Keywords:** value addition, Tobit, level of participation

## 2. INTRODUCTION

Ethiopia is one of the countries of the African continent with big honey production potential. Owing to its varied ecological and climatic conditions, Ethiopia is home to some of the most diverse flora and fauna in Africa. Its forests and woodlands contain diverse plant species that provide surplus nectar and pollen to foraging bees (Girma, 1998). Beekeeping is a long standing practice in the farming communities of Ethiopia (Ayalew and Gezahegn, 1991). More than one million households are estimated to keep bees using traditional, intermediate and modern hives (Gidey and Mekonen, 2010). The annual honey production of Ethiopia is estimated to be 45,300 metric tons which makes the country rank first honey- producing country in Africa and ninth in the world (FAO, 2010). In the country, more than ten types of traditional hives are used with an average honey yield of 5 to 8 kg per colony per year. The variation of hives is based on their volumes, shapes and the type of materials used for construction. Production is dependent on forest resources and Ethiopia's diverse sources of bee forage. (Nuru, 2007).

Southwest parts of the country in general and Kaffa, Sheka and Bench Maji Zones in particular are very potential for beekeeping. The areas are endowed with natural tropical rain forests with suitable climates that favor high honeybee population density and forest beekeeping are widely practiced (Nuru, 2007). Based on morphometric and geographical distribution analysis honeybees from southwest Ethiopia are classified as Apis melliferascutellata (Amsalu et al., 2004). From these honeybee colonies large volume of honey is produced annually (CSA, 2002). In these three Zones the majority of household keep honeybees as source of income from honey sell and beekeeping is an integral part of the farming communities of the area (Nuru, 2007). However, the honey production is very traditional which is practiced mainly by hanging traditional hives on tall trees in the dense forest far from human settlement areas (Hartman, 2004; Nuru, 2007). In areas where the forest covers was substantial the main pillar of income-generation for small-scale farmers is beekeeping (Hartman, 2004).Therefore this study was focused on assessing determinants of beekeepers participation decision and level of participation on honey value addition.

## 2. METHODOLOGY OF THE STUDY

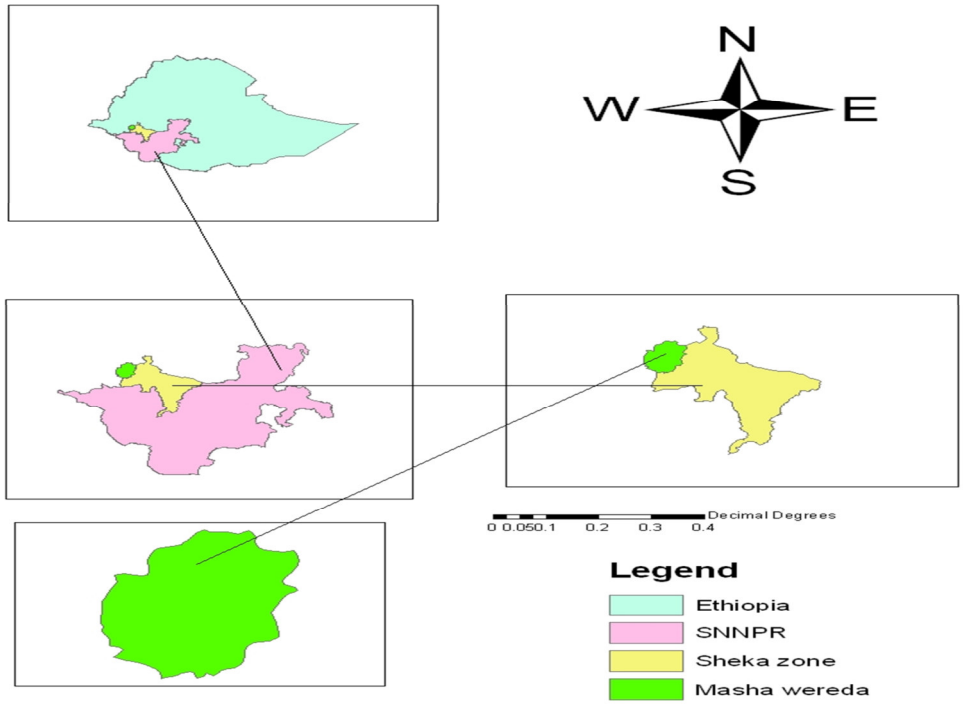
### 2.1. Description of Study Areas

This study was conducted in Masha Woreda of Sheka Zone Southwestern Ethiopia. Sheka Zone covers a total land area of 2175.25 km2. Out of this land area, 47% is covered by forest including bamboo trees. This Zone has both highland and lowland types of land features. Highlands account about 2/3 of the total area of the Zone and the rest is covered by lowlands. It is one of the almost all year rainfall receiving area with heavy rain lasting for about 8-10 months of the year. Sheka Zone has three Woredas (districts), namely Masha, Andiracha and Yeki. In total the Zone has 56 rural Kebeles, 5 urban Kebeles and 2 chartered towns or city administrations, Teppi& Masha. Masha Woreda has a total land area of about 90,802.82 hectares. Out of this land area about 23.9% is cultivated, 2.8% is grazing land, 40.5% is covered by forest, 5.5% arable land, 5.9% non-arable land and 21.4% is settled land area. This Woreda lies between 1600-2400m above sea level and receives 2000mm rainfall. Agro

climatically, the area is largely Woina dega type comprising about 75% of the total area, 22% and 3% are in Dega and kola types (CSA, 2002).Masha woreda is located at 676km southwest of Ethiopia from Addis Ababa along Addis-Jimma road. Masha woreda is notable for its relatively high forest cover as compared to other parts of Ethiopia. The forest is the major source of livelihood of the people in the area. Due to high level of dependency on forest resources, the local communities have developed traditional management practices based on religious taboos and customary tenure rights. Such management practices have sustained the forests for centuries and contributed to the better condition of the forests in the area. In general, the area is characterized by dense forests and woodlands that contain diverse plant species that provide surplus nectar and pollen to foraging bees (Tadesse and Masresha, 2007).

**Fig1. Map of the study area**




### 2.2. Sampling Procedure and Sample Size Determination

A three-stage sampling procedure was employed to select a specific honey producer household. First, one potential honey producer woreda were selected purposively from three woredas in the zone. Second, out of 19 kebeles in the district three Kebeles were selected purposively based on the presence of large number of honey producers. Finally, simple random sampling was used to select 147 representative households. The sample size of the beekeepers was determined by using Yamane (1967) formula to calculate sample size.

$$n = \frac{N}{1 + N(e)^2}$$

Where; where n is the sample size, N is the population size which is 234, and e is the level of precision which is ±5%.

Table1. Name of the kebeles and samples were taken

| No | kebeles | No of household | Honey producer households | Sample size was considered |
|---|---|---|---|---|
| 1 | Beto | 504 | 62 | 39 |
| 2 | Keja | 1311 | 103 | 65 |
| 3 | Uwa | 610 | 69 | 43 |
| | Total | 2425 | 234 | 147 |

### 2.3. Types, Sources and Method of Data Collection

Both quantitative and qualitative data were used to find out necessary results from this study. The study used both primary and secondary data sources. The secondary sources of data were journals, books, internets browsing, reports of national policy, regional, zonal and Woreda. While primary data sources includes agricultural office, Marketing and cooperative office, trade and industry office, agriculture department, trade and industry department, key informants, Development Agents (DA) and beekeepers. Finally, participatory rapid appraisal tools were conducted. The data were collected using informal and formal surveys. Data were collected from key informants by using a checklist. The formal survey was undertaken through formal interviews and questionnaires with selected beekeepers.

### 2.4. Methods of Data Analysis

#### 2.4.1. Descriptive statistics

Data collected through structured and semi-structured questionnaire survey was coded, entered, edited and analyzed by using both SPSS version16 and STATA. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to analyze the survey data collected from beekeepers.

#### 2.4.2. Econometrics analysis

To analyze determinants of beekeepers participation decision and level of participation in honey value addition Tobit model was used. Because of the restrictions put on the values taken by the regressand, this model can be called limited dependent variable regression model. The data have a censored sample as dependent variable, 55.1% of household didn't participate in honey value addition even if they produce honey from the total of 147 samples, the data are censored, and Tobit estimation is relevant. If zero values of dependent variables were the result of rational choice of farmers, a Tobit model would be more appropriate (Abrar, 2004). Thus, maximum likelihood Tobit estimation (Tobin, 1958) was used in the analysis of determinants of beekeepers participation decision and level of participation in honey value addition. One can concern with the model; recall that in a Tobit with left-censoring at zero:

$$Y^*_i = \beta_0 + \sum_{i=1}^{m} \beta i X_i + U_i, \qquad i = 1, 2 \ldots m;$$

Where Y= Y*, if Y* > 0, Y = 0 if Y* $\leq$0 and Y= max (Y*, 0)

Where $Y^*_i$ = amount of value added honey (dependent variable)

$\beta_0$ = an intercept

$\beta_i$ = coefficients of $i^{th}$ independent variable

$X_i$ = independent variable, and 'i' is 1, 2, 3… m

$U_i$ = unobserved disturbance term

Where, for the ith observation, Y* is an unobserved continuous latent variable, Yi is the observed variable, Xi is a vector of values of the independent variables, Ui is the error term, and βi is a vector of coefficients. This model assumes that Ui is uncorrelated with Xi and is independently and identically distributed.

The model parameters are estimated by maximizing the Tobit likelihood function of the following form;

$$L = \prod_{y^*>0} \frac{1}{\delta} f \frac{(Y - \beta_i X_i)}{\delta} \prod_{y^* \leq 0} F \frac{(-\beta_i X_i)}{\delta}$$

Where f and F are respectively, the density function and cumulative distribution function of $Y_{i*}$ $\Pi_{yi*}$>0 means the product over those i for which $y_{i*}$>0, and $\Pi y_{i*} \leq 0$ means the product over those i for which $y_{i*} \leq 0$.

1. The marginal effect of an explanatory variable on the expected value of the dependent variable is:

$$\frac{\partial E(Y_i)}{\partial (X_i)} = F(z)\beta_i$$

Where, $\frac{\beta_i X_i}{\sigma}$ denoted by z, following Maddala, (1997)

Where f and F are respectively, the density function and cumulative distribution function of Y**i***, πyi*>0 implied the product over those observations for which y**i***>0, and πyi* = 0 implied the product over those observations for which y**i*** = 0.

2. The change in the probability of value addition participation as independent variable $X_i$ changes:

$$\frac{\partial F(z)}{\partial X_i} = f(z)\frac{\beta_i}{\sigma}$$

3. The change in intensity of value added honey with respect to a change in an explanatory variable:

$$\frac{\partial E(Y_i / Y_i^* > 0)}{\partial X_i} = \beta_i \left[ 1 - Z\frac{f(z)}{F(z)} - \left(\frac{f(z)}{F(z)}\right)^2 \right]$$

Where, F (z) is the Cumulative Normal Distribution of z, f (z) is the value of the derivative of the normal curve at a given point (i.e., unit normal density), z is the Z score for the area under normal curve, βi is a vector of Tobit Maximum Likelihood estimates and σ is the standard error.

## 3. RESULTS AND DISCUSSIONS

### 3.1. Demographic Characteristics of Sample beekeepers

Table 2: The mean values and t-test results of independent continuous variables

| Variables | Those who participate in value addition | | Those who do not participate in value addition | | t-test |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Age | 37.8 | 6.9 | 50.7 | 10.8 | -8.7*** |
| Adult equivalent | 5.9 | 1.8 | 2.2 | 0.42 | -18.07*** |
| Distance to market | 1.7 | 1 | 4.8 | 0.78 | 0.12 |

Source: Own survey result, 2015

Compared to the farmers who participate in honey value addition, the farmers who do not participate in honey value addition had relatively lower adult equivalent, experience and quantity harvested. In addition farmers who participate in honey value addition is relatively younger than who do not participate in value addition.

Table 3: Percentage characteristics of surveyed households across honey value addition

| Variables | Those who participate in value addition | | Those who do not participate in value addition | | χ2-test |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Education | | | | | 53.1*** |
| Literate | 42 | 63.6 | 17 | 21 | |
| Illiterate | 24 | 36.4 | 64 | 79 | |
| Extension contact | | | | | 120*** |
| Frequent | 61 | 92.4 | 6 | 92.6 | |
| Non frequent | 5 | 7.6 | 75 | 7.4 | |
| Information access | | | | | 66.3*** |
| Yes | 44 | 66.7 | 3 | 3.7 | |
| No | 22 | 33.3 | 78 | 96.3 | |
| Cooperative membership | | | | | 123*** |
| Yes | 62 | 93.9 | 2 | 2.5 | |
| No | 4 | 6.1 | 79 | 97.5 | |
| Credit access | | | | | 66.3*** |
| Yes | 40 | 60.6 | 2 | 2.5 | |
| No | 26 | 39.4 | 79 | 97.5 | |
| Price of value added honey | | | | | 103*** |
| Attractive | 63 | 95.4 | 8 | 9.9 | |
| Not attractive | 3 | 4.6 | 73 | 90.1 | |

Source: Own computation from survey result, 2015

Table3 shows, farmers who participate in hone y value addition relatively had frequent extension contact, better information and credit access and they are literate as compared to farmers who do not participate in value addition. Therefore, the result shows that beekeepers participation decision and level of participation on honey value addition was influenced by education status, extension contact, information access, cooperative membership, credit access and price of value added honey.

### 3.2. Econometrics Results

The Tobit model estimated results of the variables that are expected to determine the amount of value added honey is presented in Table 16. Out of 10 variables, 7were found to significantly influence the intensity of honey

value addition. Accordingly, perception of beekeepers towards the price of value added honey, HH adult equivalent, education level of the HH head, extension service, distance to the nearest market, membership in cooperative and credit access had significantly affected the intensity of honey value addition. The overall joint goodness of fit for the Tobit model parameter estimates is assessed based on the log likelihood ratio test. The null hypothesis for the log-likelihood ratio test is that all coefficients are jointly zero. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness of fit of the Tobit model is statistically significant at a probability of 1%. This shows that jointly the independent variables included in the Tobit model regression explain the intensity of honey value addition.

Table 4: Tobit estimation result

| Tobit regression Number of obs = 147 | LR chi2 (10) = 308.75 | | | Prob > chi2 = 0.0000 |
|---|---|---|---|---|
| Log likelihood = 4.591073 | Pseudo R2 = 1.0307 | | | |
| Variables | Coef. | Std. Err. | dy/dx | Chang in probability |
| Age of the HH head | -.652 | -.225 | -.602 | -0.0012 |
| Perception of farmers towards price of value added honey | 37.106*** | 11.154 | 37.197*** | 0.332*** |
| HH adult equivalent | 4.455* | 2.945 | 4.515* | 0.0305* |
| Extension service | 32.568*** | 10.652 | 32.508*** | 0.319*** |
| Distance to the nearest market | -5.606*** | 3.951 | 5.686*** | -0.0761*** |
| Membership in cooperative | 49.896*** | 12.865 | 49.806 | 0.402*** |
| Information access | 4.746 | 2.828 | 4.706 | 0.0276 |
| Credit access | 17.830* | 10.983 | 17.601* | 0.162* |
| Training access | -13.979 | 10.635 | -12.970 | -0.130 |
| Education level of the HH head | 19.568** | 10.565 | 18.592** | 0.121** |
| _cons | -99.527 | 18.506 | | |

*** refers significance at 1%, **, significance at 5% and *significance at 10%

**Perception of farmers towards price of value added honey (priceatrv):** The perception of an individual towards the price of value added honey is factor, which affect the intensity of value added honey positively and significant at 1%. The positive perception of an individual towards the price of value added honey increase the intensity of value addition by 37.2kg. The positive perception of an individual towards the price of value added honey increase the probability of value addition participation by 33%.

**HH adult equivalent (adult):** HH adult equivalent affect the intensity of honey value addition positively and significant at 10%. If the HH adult equivalent increase by one the amount of value added honey increased by 4.5kg. An increase of HH adult equivalent by one increases the probability of value addition participation by 3%.

**Extension service (ext):** extension service affect the intensity of honey value addition positively and significant at 1%. If the HH got an extension, service the amount of value added honey increased by 32.5kg. Access to extension service increase the probability of value addition participation by 32%.

**Distance to the nearest market (dist):** distance to market is also another factor which affect the amount of value added honey negatively and significant at 1%. If the distance to the nearest market increased by one km the intensity of value added honey decreased by 5.7kg. An increase of distance to the nearest market by one km decreases the probability of value addition participation by 7.6%.

**Cooperative membership (coop):** Group membership positively contributes to the extent of value addition and significant at 1% and this can be explained by the fact that individuals in groups are easily influenced by their associates than those in isolation. They get to exchange ideas and learn about the benefits of value addition and are thus willing to take the extra step of adding value to more of their honey. Members of groups also receive training on diverse issues among them value addition and are therefore willing to take up value addition. The membership of an individual in the cooperative increase the intensity of value added honey by 49.8kg. Cooperative membership of household head increases the probability of value addition participation by 40%. This is in line with Risper (2009) who found the membership of cooperative increased the intensity of honey value addition.

**Credit access (credit):** access to credit affect the amount of value added honey positively and significant at 10%. If the HH had an access to credit, the intensity of value added honey increased by 17.6kg. Access to credit increase the probability of value addition participation by 16%.

**Education level (edu):** As hypothesized the marginal regression coefficient of education level of the household head affect the intensity of value addition positively and significant at 1% significance level. If the household head got the formal education, the amount of value added honey increased by 18.5kg. The education level of the household head increased the probability of value addition participation by 12%. This is explained by the fact that the literacy of an individual determines the readiness to accept new ideas and innovations and enhances an individual willingness to produce more and participate in value addition.

## 4. SUMMARY, CONCLUSSION AND RECOMMENDATIONS

### 4.1. SUMMARY AND CONCLUSSION

Beekeepers participation decision and level of participation on honey value addition positively associated with Perception of beekeepers towards the price of value added honey, HH adult equivalent, extension service, Cooperative membership of the household head, credit access and education level of the household head. However, distance to the nearest market affect the intensity of honey value addition negatively.

### 4.2. RECOMMENDATIONS

The results of econometric analysis (Tobit model) indicate that honey value addition and extent of participation is significantly affected by membership in cooperative (positively), the perception of beekeepers towards price of value added honey (positively), and extension service (positively), credit access (positively), education level of the household head (positively) and distance to the nearest market (negatively). Therefore, these factors must be promoted in order to increase the participation of farmers in honey value addition as well as the level of participation.

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## 6. APPENDICES

Table 1. Mfx result for Tobit estimation

| | dy/dx | Std. Err. | z | P>z | [95% Conf.Interval] | |
|---|---|---|---|---|---|---|
| age | -.9020155 | .4068779 | -2.22 | 0.027 | -1.699481 | -.1045495 |
| priceatrv | 32.19631 | 8.00178 | 4.02 | 0.000 | 16.51311 | 47.87951 |
| adueqva | 2.013641 | 1.602777 | 1.26 | 0.209 | -1.127744 | 5.155025 |
| exp | .1827488 | .6072495 | 0.30 | 0.763 | -1.007438 | 1.372936 |
| ext | 2.092025 | 8.881036 | 0.24 | 0.814 | -15.31449 | 19.49854 |
| quaharv | .4384304 | .0482568 | 9.09 | 0.000 | .3438488 | .5330119 |
| dista | 1.290371 | 2.120492 | 0.61 | 0.543 | -2.865718 | 5.44646 |
| coop | 64.19434 | 11.83809 | 5.42 | 0.000 | 40.99212 | 87.39657 |
| info | 11.41315 | 11.22423 | 1.02 | 0.309 | -10.58593 | 33.41223 |
| credit | 13.60146 | 9.262256 | 1.47 | 0.142 | -4.552228 | 31.75515 |
| training | -12.27007 | 9.67535 | -1.27 | 0.205 | -31.23341 | 6.693267 |
| edu | 18.29267 | 10.01823 | 1.83 | 0.046 | -1.342709 | 37.92804 |

Table 2. Heteroscedasticity test
Cameron &Trivedi's decomposition of IM-test (estatimtest)

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroscedasticity | 108.29 | 106 | 0.4200 |
| Skewness | 15.43 | 15 | 0.4212 |
| Kurtosis | 9.99 | 1 | 0.0016 |
| Total | 133.70 | 122 | 0.2210 |

Table 3. Contingency coefficients for the discrete variables in the Tobit model

| | edu | priceatrv | ext | info | coop | credit | Training |
|---|---|---|---|---|---|---|---|
| edu | 1.0000 | | | | | | |
| priceatrv | 0.5291 | 1.0000 | | | | | |
| ext | 0.6204 | 0.6363 | 1.0000 | | | | |
| info | 0.5934 | 0.6022 | 0.6320 | 1.0000 | | | |
| coop | 0.6251 | 0.5227 | 0.6088 | 0.6412 | 1.0000 | | |
| credit | 0.5679 | 0.6332 | 0.5702 | 0.5580 | 0.6121 | 1.0000 | |
| training | 0.6382 | 0.6500 | 0.6243 | 0.6487 | 0.6190 | 0.5528 | 1.0000 |

Table 4. Variance inflation factor

| VIF when all explanatory variables are together | | | VIF for all continuous variables only | | |
|---|---|---|---|---|---|
| Variable | VIF | 1/VIF | Variable | VIF | 1/VIF |
| age | 7.18 | 0.139315 | age | 5.12 | 0.195446 |
| priceatrv | 6.33 | 0.157886 | adueqva | 4.92 | 0.203081 |
| adueqva | 5.80 | 0.172296 | exp | 4.72 | 0.212081 |
| exp | 5.33 | 0.187648 | quaharv | 3.03 | 0.330442 |
| ext | 5.26 | 0.189968 | dista | 2.49 | 0.400937 |
| quaharv | 4.90 | 0.204254 | Mean VIF | 4.09 | |
| dista | 4.72 | 0.211815 | | | |
| coop | 4.57 | 0.218618 | | | |
| info | 4.38 | 0.228475 | | | |
| credit | 4.01 | 0.249202 | | | |
| training | 3.86 | 0.258825 | | | |
| edu | 3.51 | 0.285003 | | | |