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DETERMINANTS OF MARKET SUPPLY OF HONEY IN LEMU AND BILBILO DISTRICT, ARSI ZONE OF OROMIA REGIONAL STATE, ETHIOPIA

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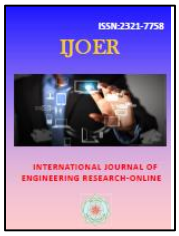

ABSTRACT

The study was initiated to examine the determinant of market supply of honey in Lemu and Bilblo District, Arsi Zone of Oromia Region, Ethiopia. The focus of the study was: examining determinants of honey supplied to the market and identifying Sales of honey to different actors in the study area. A two stage sampling procedure was employed and in first stage, four representative potential honey producer kebeles were selected purposively. In the second stage, using the population list of households from sample farmer, the representative honey producer was randomly selected using simple random sampling technique. Both primary and secondary data were utilized, selected farm households and actors involved in the chain were used as a primary source through structured interview, Secondary data was collected from different published and unpublished sources. The results of multiple linear regression model analysis pointed out that: Quantity of honey produced, Extracted honey supplied to the market, Total land owned of the household, honey production place, Total numbers of Bee colonies owned and previous price of honey were found to be significant. Increasing the distribution of modern beehives would bring additional marketable supply of the produce because the average honey produced from modern beehive is by far higher than that of traditional hive.

Keywords: Determinants, Honey, Market, Linear regression

1. INTRODUCTION

1.1. Background of the study

Beekeeping refers to a management of honey bee colonies for honey production, pollination of crops and other products (Taye, 2013). Bees produce honey that is the sweetest food in the world. Honey can be used as a natural healing agent, good for the heart, skin, destroys bacteria, helps in the digestion, safe than sugar and lowers cholesterol.

From the top largest honey trader countries in the world, Chaina is the first largest exporters and consumers of honey (Abayomi 2018), Ethiopia stands first from Africa and one of the top 10 (ten) of the world in honey production (Legesse, 2014 and Gemechis, 2015). In different parts of Ethiopia beekeeping is practiced for an income-generating and honey consumption activities because there is a concept of honey production and marketing are fit well for the small scale agricultural development (MoA and ILRI, 2013).

Beekeeping is also an activity that goes with environment and does not compete for scarce land resources as other agricultural activities and provides employment during off-season and income-generating opportunity for smallholders (Workneh, 2011). Tarekegn *et al*. (2017), identified that beekeeping activities should be operated side by side with other agricultural activities to support rural economy.

For those who engaged in honey production and marketing activity, it can create substantial income (Tizazu *et al*., 2017). In Ethiopia, only about 10% of the honey produced in the country is used for consumption by the beekeeping households. The remaining 90% is sold for income generation and of this amount, it is estimated that 80% is used for *Teji* brewing (Gemechis, 2016). According to Chala, *et al.* (2013), though the national honey production satisfies the local demand, it could not compete in the international market, because it is too crude.

The whole domestic honey market lacks proper structure and legality. The beekeepers complain the business as not rewarding and even lacking market for their product, while the consumers see the ever increasing price of honey as unfair. In many cases, adulteration of honey has been a frustrating factor for both the producers and legal buyers and sellers as the traceability and accountability is hardly possible (Gemechis, 2016).

Improved information and marketing facility enable farmers to plan their production more in line with market demand, to schedule their harvest at the most profitable time, and to negotiate with traders (CIAT, 2004). According to MoA and ILRI (2013), enhancing the ability of poor smallholder farmers to reach markets and actively engaging them is one of the most pressing development challenges. Without having convenient marketing conditions, the possible increment in output, rural incomes, and foreign exchange resulting from the introduction of improved production technologies could not be effective.

In Ethiopia the existing income generation capacity of honey as compared to its huge potential is not encouraging, due to high knowledge gap on honey production and marketing techniques (Fenet and Alemayehu, 2016).

Despite the available potentials and opportunities for honey production and high market demand, there were no adequate and reliable information on the determinants of honey marketing in Lemu and Bilblo district. Information about honey production and marketing can allow households to increase their income by producing output with higher return. Thus, investigating the determinants of honey marketing is important in the study area in order to identify the bottlenecks of honey marketing to meet the demand of local consumers and exporters in the country and to enhance agricultural transformation.

Therefore, this study was conducted to asses' determinants of honey marketing in Lemu and Bilbilo district with the following specific objectives.

- Examining determinants of honey supplied to the market in the study area.
- Identifying Sales of honey to different actors.

1.2. Description of the Study Area

The study was conducted in Lemu and Bilbilo district, Arsi zone of Oromia Regional State. Lemu and Bilbilo district is located about 235 kms southeast of Addis Ababa, 56 kms south of Asella. There are 25 Kebeles available in the district. The district is characterized as bimodal rainfall pattern with yearly average rainfall of 940 mm. The average annual temperature ranges from 6°c to 26°c, (Mesay, *et al*., 2017).

The district is characterized by crop-livestock mixed farming system where crop production is dominant. The major crops grown are annual crops such as cereals, pulses, oilseed and vegetables (Samuel, *et al.*, 2017).

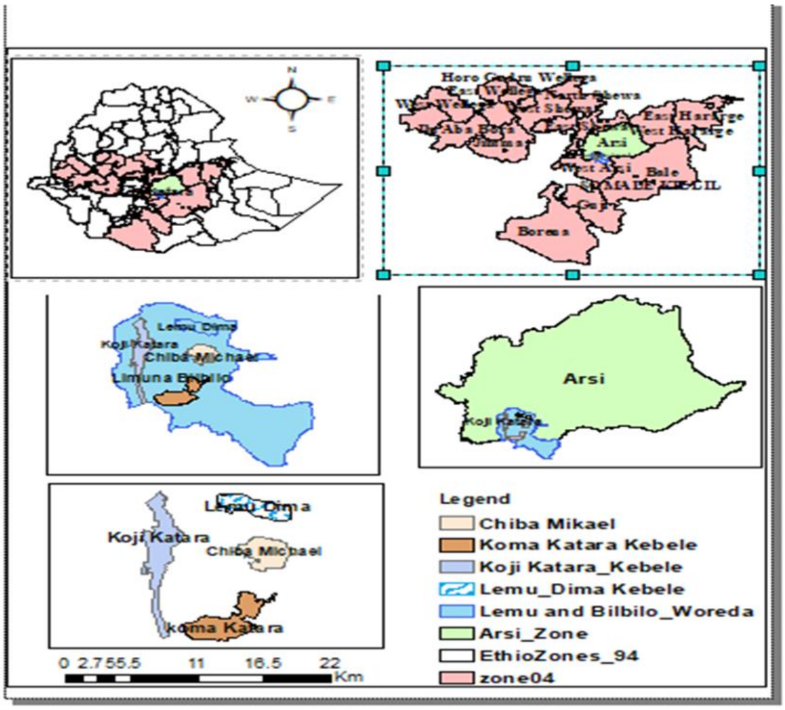

Figure1: Map of the study area

1.3. Sample Size and Method of Sampling

The sampling frame of the study was the list of honey producer households in selected kebeles, which are found in the district. A two stage sampling procedure has been employed to select the specific respondents. In first stage, four representative potential honey producer kebeles from the district have been selected through purposively based on honey producing potentials. In the second stage, using the population list of honey producer farmers from sampled kebeles, the representative honey producer households were randomly selected using simple random sampling technique. The intended sample size had been determined by employing probability proportional to population size using formula given by (Yamane, 1967), at 5% level of precision: As a result, the survey was administered and data were collected and analyzed on 311 respondents of honey producers.

$$\frac{N}{1+N(e)^2} \text{ .... (1)}$$

Where: n = is the sample size,

N = is total size of honey producer households of selected kebeles, and

e = the level of precision it is 5%

n = $1406/1+1406(0.05)^2$ = 1406/1+1406(0.0025) = 311 respondents.

1.4. Data types, sources and methods of data collection

The study was used both primary and secondary data and selected honey producer households and actors involved in honey production and marketing were used as a source for collecting primary data through structured interviews. Independent questionnaires were designed for both honey producers and traders.

1.5. Method of data analysis

In this study both descriptive statistics and econometric analysis were used for analyzing the data collected from honey producers and traders. The descriptive includes, like percentage, mean, standard deviation and figures were used to explain basic characteristics of the honey production and marketing besides econometric models.

1.5.1. Econometric model for quantity supplied to market

To analyze the determinants of honey supplied to the market, different models like multiple linear regressions, Tobit and Heckman's

sample selection models can be employed. If some households may not participate in a particular market due to different reasons and at this time Tobit or Heckman models are used. By using Tobit model, the market supply can be analyzed by clustering the respondents' into supplier and non-suppliers. If censored regression is applied, the model estimates are biased because of there is no clustering honey producers as all of households supply their product to market (Wooldridge, 2010).

However, in the study area all honey producers participate in the market by supplying their produce and therefore no need of clustering of honey producers in honey market participant and non-participant. Different research conducted by different researcher utilized multiple linear regression, few of them are: Muhammed (2011), Samuel (2014), Tizazu *et al.*(2017), and Kassa *et al.* (2018), employed similar model. Thus, for this study, multiple linear regression model was used to identify determinants of honey supplied to market.

1.5.2. Model Specification

The main hypothesized variables expected to influence quantity of Honey supplied to market in the study area were explained in the following manner:

The multiple linear regressions model is used to explain the relationship between one continuous dependent variable and two or more independent variables (Gujarati, 2003). The independent variables can be continuous or categorical (dummy coded as appropriate) while the dependent variable should be continuous and specified as:

Quantity of honey supplied to the market (**Y**) = **f** (Education level of households, Experience of households in beekeeping, Family size of households, Access to market information, Land owned of the respondent, Availability of bee flora, Total numbers of Bee colonies, Quantity of honey produced, Distance from nearest market, Honey production place, Extracted honey supplied to market, Average price of honey (2017/2018) and Number of extension contact in a year).

The model for a dependent variable 'Y' with observed value y_1, y_2, $y_3 \ldots y_n$ (Where **n** is the sample size) and **r** independent variables x_1, x_2, $x_3 \ldots x_n$ with observed value x_{1i}, x_{2i}, $x_{3i} \ldots x_{ri}$, i= 1, 2, 3…n and the specification of supply functions in matrix notation is estimated by:

$$Yi = B_o + B_1X_{1i} + B_2X_{2i} + B_3X_{3i} + - - - + B_r X_{ri} + U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, Y_i is the dependent Variable

X_i is explanatory (independent) variables, i = 1, 2, 3... n

β_0 is the constant term;

β_i is the coefficients for a given explanatory variable i and

U_i is i^{th} random error term (disturbance term)

The term U_i is the residual or random error for individual i and represents the deviation of the observed value of the response for this individual from that expected by the model. These error terms are assumed to have a normal distribution with mean zero and constant variance σ^2. Thus, $\hat{u}_i = Y_i - \hat{Y}_i$ is normally distributed with mean zero and constant variance σ^2.

1.5.3. Hypothesized Variables and their definition

In identifying factors affecting amount of honey supplied to the market, the main task were exploring which factors potentially influence and how these factors are related with the dependent variables. Therefore, the following dependent and independent variables were hypothesized in the study.

1.5.3.1. Dependent variable

Quantity of honey supplied to the market (QTHSSMT): It is a continuous variable that represents the dependent variable; the actual supply of honey by individual households to the market in a year 2017/2018, which is measured in kilograms.

1.5.3.2. Independent variables

The following explanatory variables were hypothesized to influence honey supplied to the market in the study area.

Quantity of honey produced (QTYHP): It is a continuous variable measured in kilograms. The variable is expected to have positive contribution to the amount of honey supplied to the market. Similarly research conducted by Bosena (2008), Assefa, (2009) and Samuel (2014) found that the amount of, honey produced by household affected market supply of the commodity significantly and positively.

Average price of honey in 2016/2017 (AVPRICE): It is a continuous variable and is measured in Birr per kilogram. This variable is expected to influence honey supplied to market positively. The study of Assefa, (2009) on market chain analysis of honey production found a significant positive relationship between honey sold and current price. When the price of the product is promising, farmers are motivated to take their produced to the market. This makes the supply to be directly related to the current market price.

Experience in beekeeping (EXPRCE): It is a continuous variable which refers to the number of years the farmer engaged in beekeeping activity and is expected to influence honey supplied to market positively. Betselot (2012), Samuel (2014) and Kassa (2018) found as beekeepers experience increased the volume of honey supplied to the market increased. This means that the beekeepers with more experience in honey production and marketing have higher ability to produce honey in turn sell more than less experience because they have more knowledge in bee management and marketing network.

Family size of the household (FAMSIZE): It is a continuous variable and is measured in adult equivalent; it refers to the number of households engaged in beekeeping activity and is expected to influence production and marketing of honey positively/negatively. Gebiso T. (2015) due to utilization of the family labor as family size increases the adoption probability also increases. Dawit, (2010**)** found that family size influence market participation decision negatively. This can be due to the fact that if the family number increases some may involve in poultry production while others may be idle, due to these, some of labor force shift to other activities, as alternative sources of income.

Access to market information (ACCMINFO): This is measured as a dummy variable taking value of 1 if the producer had access to market information and 0 otherwise. Muhamed, (2011) found that access to market information positively affects quantity supply of teff at 5% significance level.

Availability of bee flora (AVBEFLR): It is a dummy variable taking value of 1 if bee flora is available for producer and 0 otherwise. It is expected to have positive contribution to the amount of honey supplied to the market. Gebiso T. (2015) lack of additional bee feed (forages) and change in weather conditions, affects beekeeping by reducing flora. Asefa (2009) found that out of total respondent about 75% replied that bee forage is a problems encountered by sample respondents.

Honey production place (**HPROPLC):** It is dummy variable that takes a value of 1 if the household head keeping bee at backyard and 0 otherwise. It is expected to have positive contribution to the amount of honey supplied to the market. Taye, B.,and Marco, V (2014), Assessment of constraints and opportunities of honey production in Wonchi District South West Shewa Zone found that, only few beekeepers keep their bees at a backyard.

Extracted honey supplied to market (EXTHSSM): It is dummy variable that takes a value of 1 if the household head supplied crude honey to market and 0 otherwise. It is expected to have positive contribution to the amount of honey supplied to the market. Asefa (2009) found that out of total respondent about 64.5% replied that quality problem is the priority problem identified. Taye, B.,and Marco, V (2014), found that, Farmers who do not strain honey loses a lot of money due to lacked of knowledge and materials.

Total Land owned (TLNDOWND): It is a continuous variable and measured in hectors. It refers to the number of land allocated for beekeeping activity and expected to influence production of honey positively and increased quantity of honey supplied to market

Number of extension contact in a year (NUEXCONT): it is a continuous variable measured by the number of contact with extension agent in the year. The variable is expected to have positive contribution to the amount of honey supplied to the market. Study by Biruk, (2015), and (Tizazu *et al*., 2017) shows that extension contact and its frequency has positive impact on volume of output and then amount supplied to the market. (Kassa, *et al.,* 2018), found that increase in number of extension contacts per year increases the amount of honey marketed. Frequent extension contact provides information regarding improved technology which improves production that in turn affects the marketed surplus positively.

Total number of bee colonies owned (TNBCO): It is a continuous variable and is expected to have positive contribution to the amount of honey supplied to the market. Kerealem *et al.,* (2009), and Kassa *et al.,* (2018), confirmed that the use of large number of hives directly related with the amount of honey supplied to the market.

Table.1: Description of the dependent and independent variables

Variables	Description	Category	Value	Expected sign
Dependent				
Y(QTHSSMT**)**	Quantity of honey Supplied to the market	Continuous	Kilograms	
Independent				
QTYHP	Quantity of honey produced	Continuous	Kilograms	+
AVPRICE	Average price of honey 2016/2017	Continuous	Birr per Kilograms	+
ACCMINFO	Access to market information	Dummy	1= yes 0= No	+
EXPRCE	Experience in beekeeping	Continuous	Number of years	+
FAMSIZE	Family size of the households	Continuous	Adult equivalent	+/ -
AVBEFLR	Availability of bee flora	Dummy	1= yes 0= No	+
TLNDOWND	Total Land owned	Continuous	Hectors	+
HPROPLC	Honey production place	Dummy	1= yes 0= no	+
EXTHSSM	Extracted honey supplied to market	Dummy	1= yes 0= no	+
EDUCLEV	Education level of households head	Continuous	School grade	+
DISMKT	Distance from the Nearest Market	Continuous	Kms	-
TNBCO	Total number of bee colonies owned	Continuous	Numbers	+
EXTCONT	Number of extension contact in a year	Continuous	Numbers	+

Source Own computation (2019)

Education level of the household (**EDUCLEV):** It is a continuous variable and refers to the formal Schooling of a respondent during the survey period. The variable is expected to have positive contribution to the amount of honey supplied to the market. Assefa, (2009) indicate that education has a positive effect on honey sale quantity per household per year. The positive and significant relationship indicates that education improves the beekeeping household ability to acquire new idea production related and market information.

Distance to the nearest Market (DISMKT): It is a continuous variable and measured in kilometers which farmers spend time to sell their product to the market and is expected to influence honey supplied to market negatively. Biruk (2015) and Kassa (2018) found that as the distance of the farmers' residence from the nearest market increases, the volume of honey supplied decreased, this implies that as the distance from the nearest market increases, transport costs and loss due to handling increase and this may discourages producers from selling high volumes of honey.

1.6. Model Adequacy Checking

When the assumptions of the Classical Linear Regression (CLR) model are violated, the parameter estimates of the OLS model may not be Best Linear Unbiased Estimator (BLUE). Hence, it is important to check the presence of multicollinearity and heteroscedasticity among the variables that affect the supply of honey in the study area. Therefore, before fitting significant variables into the model for analysis, it is necessary to test multicollinearity problem among variables, which seriously affects the parameter estimates. Gujarati D. (2003), indicates, multicolliniarity refers to a situation where it becomes difficult to identify the separate effect of independent variables on the dependent variable. In other words, multicollinearity is a situation where explanatory variables are highly correlated. There are different measures, which suggested testing the existence of multicollinearity. The Variance Inflation Factor (VIF) is the one which is used for the test of multicollinearity. To detect multicollinearity, variance inflation Factor (*VIF)* for each coefficient in a regression as a diagnostic statistic is used. According to Gujarati (2003) VIF (Xj) is defined as

$$VIF = 1/1-R_i^2 \quad \ldots\ldots (3)$$

Here, R_i^2 represents a coefficient for determining the subsidiary or auxiliary regression of each independent variable X. As a rule of thumb, if VIF value of a variable exceeds 10, which will happen if R_i^2 exceeds 0.90, then, that variable is said to be highly collinear.

There are a number of test statistics for the detecting heteroscedasticity; According to Gujarati (2003) there is no ground to say that one test statistics of hetroscedasticity is better than the others. Therefore, due to its simplicity, test will be based on the squared residuals u^2_i. However, instead of being regressed on one or more regressions, the squared residuals are regressed on the squared estimated values of the regress.

2. RESULTS AND DISCUSSIONS

2.1. Quantity of honey supplied to the market

The amount of honey supplied to the market in a year 2018, out of 7589kgs of honey produced by 311 honey producers, 5,747kgs of honey supplied to different markets (table2). The average quantities of honey supplied by respondents were 18.48kgs ranges from 2 to 300kgs. The average price of honey in 2017/2018 budget year was 196.65birr ranges from 115 birr to 325birr.

Table 2: Quantity of honey supplied to the market in kgs

	n	min	max	Sum	Mean	percent
Quantity of honey supplied to market in a year 2018	311	2	300	5747	18.48	100
Average price of honey in 2017/2018	311	115.	325	-	196.65	

Source: Survey result, 2019

2.2. Types of honey supplied and access to market information

Out of total respondents 105 (33.8%) supplied extracted honey to market whereas 206 (66.2%) the majority of the respondent supplied crude honey to the market. From sampled respondents 203(65.3%) had information about honey market and 108(34.7%) of the respondent had no information about honey markets.

Table 3: Types of honey supplied and access to market information

Variables	Respondents	Frequency	Percent (%)
Extracted honey supplied to the market	Yes	105	33.8
	No	206	66.2
Access to market information	Yes	203	65.3
	No	108	34.7

Source: Survey result, 2019

According to the collected data from sampled households all of honey supplier respondents (100%) participated in sales of honey at village market, whereas 218 (70.1%) of respondents participated in sales of honey at Bokoji market while 4 (1.3%) respondents sold at Asella market and only 1(0.3%) respondent sold at Adama market. This result indicated that more than 98% of honey supplier's sampled respondents participated on honey market at village and Bokoji town (table4).

Table 4: Honey marketing place

Market place		Frequency	Percent
Marketing of honey at Village market	Yes	311	100
	No	0	0
	Total	311	100
Marketing of honey at Bokoji market	Yes	218	70.1
	No	93	29.9
Marketing of honey at Asella market	Yes	4	1.3
	No	307	98.7
Marketing of honey at Adama market	Yes	1	0.3
	No	310	99.7

Source: Survey result, 2019

2.3. Sales of honey to different actors

Out of 311 honey supplier's respondents, 309 (99.4%) directly sales their honey to consumers, only 2 respondents (0.6%) was not participated. Among the respondent's 44(14.1%) of producers were participated in sales of honey to retailers while 267 (85.9%) were not participated(table 5). About 105 (33.8%) of respondents participated in sales of honey to collectors whereas 206(66.2%) was not participated. None of the respondents participated in sales of honey to whole sellers and processors because there are no known whole sellers and processors in the study area.

Table 5: Sales of honey to different actors

Buyers		Frequency	Percent
Consumers	Yes	309	99.4
	No	2	0.6
Retailers	Yes	44	14.1
	No	267	85.9
Collectors	Yes	105	33.8
	No	206	66.2

Source: Survey result, 2019

As it is shows n on Table 6, shows the amount and percentage of honey supplied to different market participant

Table 6: Amount of honey supplied to different market participants in 2017/18

Market participants /channels	Amount in kgs	Percent (%)
Producers to consumers	4598	80.00
Producers, collectors, to consumers	468	8.14
Producers, retailers to consumers	287	5.00
Producers, collectors, retailers to consumers	394	6.86
Total	5747	100

Source: Survey result, 2019

2.4. Determinants of Honey Supply to the Market

The econometric analysis is used to identify factors that affect supply of honey to the market in Lemu and Bilbilo district. The multiple linear regression result presented in the table 7: below. The statistical tool used to analyze the result was STATA14.

2.4.1. Results of the multiple linear regression model

Thirteen explanatory variables were hypothesized to determine the household level honey supply to market. Among the hypothesized 13 variables namely: Education level of the household (EDUCLEV), Family size of the household (FAMSIZE), Experience in beekeeping (EXPRCE), Total land owned of the household (TLNDOWND), Availability of bee flora (AVBEFLR), Total numbers of Bee colonies owned (TNBCO), Quantity of honey produced (QTYHP), Distance to the nearest Market (DISMKT), Access to market information (ACCMINFO), Honey production place (HPROPLC), Extracted honey supplied to market (EXTHSSM), Average price of honey 2016/2017 (AVPRICE) and Number of extension contact in a year (NUECONT).

From the above independent variables six of them were found to be significantly affected honey supply to the market at household level (Table 4.19). Quantity of honey produced, Extracted honey supplied to market, Average price of honey 2016/2017, Honey production place, Total land owned of the household, and Total numbers of Bee colonies owned influenced honey supply to the market positively as predicted. The remaining 7 variables (Education level of the household, Family size of the household, Experience in beekeeping, Availability of bee flora, Distance to the nearest Market, Access to market information, and Number of extension contact in a year) were found to have no significant effect on honey supply to market.

Quantity of honey produced (QTYHP): As hypothesized the multiple linear regression output variable was significant at 1% significant level, a positive coefficient implies that an increase in quantity of honey produced increases honey market supply of farmers. It indicates that households who produce more quantity of honey had also supplied more to the market. The result also shows that, a 1kg increase in the quantity of honey produced per beehive causes a 0.73 kilograms increase in the amount of Honey supply to market ceteris paribus. This result is in line with that of Kassa *et al.,* (2017) that showed an increase in quantity of Honey produced increases volume of marketable supply of honey by farmers.

Extracted honey supplied to market (EXTHSSM): As hypothesized the multiple linear regression output variable was significant at 1% significant level, a positive coefficient implies that an increase in quantity of extracted honey supplied to market increase quality of honey supply to the market other things remain constant. It indicates that households who produce more quantity of extracted honey had also supplied more to the market. This result is in line with that of Asefa (2009) and Taye, B. and Marco, V (2014), showed that an increase in quantity of extracted honey increases volume of marketable supply of honey by farmers.

Total land owned of the household (TLNDOWND): this variable affected the supply of honey to the market positively and significantly at 5% of

significance level. The result implied that, those farmers' which has more land allocated produced more and also supplied more to market. The result also implied that, a unit increase in land allocation can increase the amount of Honey supply to the market by more than 1.4kgs, other things remain constant. Previous studies conducted by Samuel (2014) and Tarekegn *et al.,* (2017) found that total land owned of the household in honey production increases the amount of Honey supply to market.

Honey production place (HPROPLC): this variable affected the supply of honey to the market positively and significantly at 5% of significance level. The result implied that, those farmers' which produced honey at backyard site supplied more to market. It is due to simplicity of beekeeping at backyard than forest. Previous studies conducted by Taye, B. and Marco, V (2014), found that place of honey production has a significant effect on the amount of Honey supply to market.

Table 7: OLS results of determinants of honey supply to market

Source	SS	df	MS	No of Observation = 311
Model	289332.671	13	22256.3593	F(13, 297) = 78.25
Residual	84477.2708	297	284.435255	Prob > F = 0.0000
				R-squared = 0.7740
Total	373809.942	310	1205.83852	Adj R-squared = 0.7641
				Root MSE = 16.865

QTHSSMT	Coef.	Std. Err.	T	P>t
cons	5.617176	6.667787	0.84	0.400
EDUCLEV	.1857854	.3029659	0.61	0.527
FAMSIZE	-1.158064	.6893982	-1.68	0.094 *
EXPRCE	.1141451	.1430404	0.80	0.426
TLNDOWND	1.43519	.5430502	2.64	0.009 **
AVBEFLR	1.040771	2.066627	0.50	0.615
TNBCO	. 7612836	.3576947	2.13	0.034 **
QTYHP	. 6800594	.0459634	14.80	0.000 ***
DISMKT	-.3958239	.3383844	-1.17	0.243
ACCMINFO	2.106495	2.295864	0.92	0.360
HPROPLC	4.725858	2.253114	2.10	0.037 **
EXTHSSM	7.369936	2.243521	3.28	0.001***
AVPRICE	.0616096	.0270758	2.28	0.024 **
NUCONT	.7603507	1.036664	0.73	0.464

Source: Own computation, 2019

Dependent variable = quantity of honey supplied to market (QTHSSMT),

Number of observation =311, R-squared = 0.7740, Adj. R-squared = 0.7641.

The symbol ***, ** and * indicates the variables statistically significant at 1%, 5% and 10% significant level respectively.

Total numbers of Bee colonies owned (TNBCO): As hypothesized the multiple linear regression output variable was significant at 5% significant level, a positive coefficient implies that an increase in quantity of bee colonies (beehives) increases honey market supply of farmers. It indicates that households who produce more quantity of honey had also supplied more to the market. The result also shows that, a 1colony increase in honey production causes a 0.76 kilograms increase in the amount of Honey supply to market ceteris paribus. This result is in line with that of Kassa *et al.,* (2017) and Betselot (2012) that showed an increase in quantity of Honey bee hives increases volume of marketable supply of honey by farmers

Average price of honey 2017/2018 (AVPRICE): As hypothesized the multiple linear regression output variable was significant at 5% significant level. A

positive coefficient implies that an increase in price of honey increase honey market supply of farmers. The result also shows that, a unit increase in price of honey causes a 0.06kilograms increase in the amount of Honey supply to market ceteris paribus. This result is in line with that of Assefa, (2009), market chain analysis of honey production found a significant positive relationship between honey sold and current price.

2.4.2. Model Adequacy Checking results

Interpretation of OLS estimates is possible if and only if the basic assumptions of multiple linear regression models are satisfied. Thus, after regression of the model existence of multicolliniarity between the hypothesized explanatory variables were checked with variance inflation factors (VIF). The VIF has a mean of 1.59 which indicates the nonexistence of serious Multicolinearity problem among explanatory variables.

In this study heteroscedasticity was tested for variables by running the Breusch-Pagan / Cook-Weisberg test used for testing heteroskedasticity. The result chi2 (1) = 0.58 and the Prob > chi2 = 0.4461 indicated that there is no serious problem of heteroscedasticity. Even though heteroscedasticity is a problem of cross sectional data, the error term in the regression has constant variance. The problem of outliers in the data was checked using the box plot graph and the graph shows that no serious problems outliers in the model. The normal distribution of residuals was checked by using kernel density estimation graph. Although the graph showed a minor deviation from normal density at pick center of the curve, the kernel density estimate curve are close to a normal density curve

The overall goodness of fit of the regression model is measured by the coefficient of determination (R^2). It tells what proportion of the variation in the dependent variable, or regress and, is explained by the explanatory variable. The adjusted R-squared was used to determine the goodness of the model and the value of adjusted R-squared = 0.7641 indicated that 76 % of the variation in the dependent variable was explained by the independent variables included in the model.

3. CONCLUSION AND RECOMMENDATIONS

3.1. Conclusions

The results of multiple linear regression model analysis pointed out that:

Quantity of honey produced by individual households was found to influence the quantity supply significantly and positively during the survey time. A positive coefficient implies that an increase in quantity of honey produced increases honey supplied to the market.

Extracted honey supplied to market was found to influence the quantity supply significantly and positively during the survey time. This indicated that households who produce more quantity of extracted honey had also supplied more to the market.

Total land owned of the household was found to influence the quantity supply significantly and positively during the survey time. The result implied that, those farmers' which allocated more land for honey production supplied more to market.

Honey production place: this variable was found to influence the quantity supply significantly and positively during the survey time. The result implied that, those farmers' which produced honey at backyard site supplied more to market. It is due to simplicity of beekeeping at backyard than forest.

Total numbers of Bee colonies owned: the variables was found to influence the quantity supply significantly and positively during the survey time. It indicates that an increase in quantity of bee colonies (beehives) increases honey market supply of farmers.

Average price of honey 2017/2018 was found to influence the quantity supply significantly and positively during the survey time. The result implied that, increase in price of honey increases honey supplied to market.

3.2. Recommendations

Based on the above conclusion the following recommendations are forwarded

1. Quantity of honey produced by individual households was found to influence the quantity

supply significantly and positively during the survey time. Increasing the distribution of modern equipment would bring additional marketable supply of the produce. Arsi zone livestock resource development office can take the initiation in collaboration with Asella agricultural engineering research center and Arsi University.

2. Extracted honey supplied to market was found to influence the quantity supply significantly and positively during the survey time. This indicated that households who produce more quantity of extracted honey had also supplied more to the market. District Arsi zone livestock resource development office should have to provide extension services how to extract honey and availability of the extractor on the market.

REFERENCES

[1]. Abayomi, J. (2018): https://www.trendrr.net/6124/top-10-largest-honey-producing-Countries-world-famous-best/

[2]. Assefa, A. (2009), Market Chain Analysis of Honey Production in Atsbi wemerta district, Eastern zone of Tigray National State. A MSc Thesis presented to School of Graduate Studies of Haramaya University. 67-69p

[3]. Betselot Mesfin (2012). Honey value chain analysis with especial emphasis to Ada'adistrict, East Shoa zone of Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia Bihon,K. (2015). Factors affecting agricultural production in Tigray Region, Northern Ethiopia

[4]. Biruk, J. (2015). Value Chain Analysis of Bee Honey and Credit Market Participation of Bee Keepers: The Case of Damot Gale District, Southern Ethiopia

[5]. Bosena, T.(2008). Cotton market chain analysis: the case of Metema Woreda, North Gondar Zone, Amhara National Regional State. An MSc Thesis Presented to School of Graduate Studies of Haramaya University. 123p.

[6]. Chala, K.,Taye, T., and Kebede, D. (2013), Assessment of Honey Production and Marketing. System in Gomma District, South Western Ethiopia

[7]. CIAT, (2004). (Centro International de Agricultural Tropical). Increasing the Competitiveness of market chains of smallholders producers. Manual,3: Teritorial Approcch to Rural Agro Enterprise Development Project.

[8]. Dawit, (2010) Market Chain Analysis of Poultry: the case of Alamata and Atsbi wonberta woredas of Tigray Region: Msc Thesis, Haramaya University, Haramaya, Ethiopia

[9]. Fenet, B., and Alemayehu, O., (2016). The Significance of Honey Production for Livelihood in Ethiopia Jimma University

[10]. Gebiso, T. (2015). Adoption of Modern Bee Hive in Arsi Zone of Oromia Region: Determinants and Financial Benefits.

[11]. Gemechis, L. (2016). Honey production and marketing in Ethiopia, agriculture and biology Journal of North America ISSN Print: 2151-7517, ISSN Online: 2151-7525, doi: 10.5251/abjna.2016.7.5.248.253

[12]. Gemechis, T. (2015). Honey Production and Marketing in Ethiopian. American Journal of Life Sciences. 3(1): 42-46. doi:10.11648/j.ajls.20150301.18. Accessed on May 11, 2016.

[13]. Gujarati, D. (2003). Basics of econometrics,4th edition. McGraw hill Company, IN United States Military Academy, West point

[14]. Kassa, T., (2017), Analysis of honey market chain: the case of chena woreda, kaffa zone, southern Ethiopia Amhara national regional state. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

[15]. Kassa, T., Gonche, G., and Amenay, A. (2018). Value Chain Analysis of Honey in Kaffa and Sheka Zones of SNNPR, Ethiopia

[16]. Kassa, T., Jema, H., and Bosena, T. (2017). Factors affecting market supply of honey in Chena district, Kaffa zone, Southern Ethiopia

[17]. Kerealem E, Tilahun G, Preston TR (2009). Constraints and Prospects for Apiculture

[18]. Research and Development in Amhara region, Andassa Livestock Research Center, Bahir Dar, Ethiopia. Available at: http://www.lrrd.org/lrrd21/10/ejig21172.htm

[19]. Legesse, G. (2014). Review of progress in Ethiopian honey production and marketing: Livestock's Research for Rural Development. Volume 26, article #14.

[20]. Mesay, Y., Bedada, B., and Getachew, L. (2017) Improving the competitiveness of dairy Production via value chain approach: The case of Lemu and Bilbilo district in Arsi highlands of Ethiopia

[21]. MoA and ILRI, (2013), Apiculture value chain vision and strategy for Ethiopia. Addis Ababa, Ethiopia: Ministry of Agriculture and International Livestock Research Institute

[22]. Muhammed, u. (2011) market chain analysis of teff and wheat production in halaba pecial woreda, southern Ethiopia

[23]. Samuel, S. (2014).Market chain analysis of honey production in Sodo Zuria district, Southern Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

[24]. Tarekegn, K., Haji, J., and Tegegne, B. (2017). Determinants of honey producer market outlet choice in Chena District, southern Ethiopia.

[25]. Taye, B. (2013). Assessment on the Services of wonchi Beekeepers' Association: The Case of Wonchi District, South West Shoa Zone, Ethiopia.

[26]. Taye, B., and Marco, V. (2014). Assessment of constraints and opportunities of honey Production in Wonchi District South West Shewa Zone of Oromia, Ethiopia. American Journal of Research Communication, 2014, 2(10): 342-353} www.usa-journals.com, ISSN: 2325-4076.

[27]. Tizazu, T., Bosena T., and Lemma, Z. (2017). Determinants of Honey Market Supply: The Case of Shebedino District, Sidama Zone, Snnpr, Ethiopia. Journal of Economics and Sustainable Development. ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online) Vol.8, No.19, 2017

[28]. Workneh, A. (2011), Identification and documentation of indigenous knowledge of beekeeping practices in selected districts of Ethiopia. Journal of Agricultural Extension and Rural Development 3(5):82–87.

[29]. Wooldridge JM (2010). Econometric Analysis of Cross Section and Panel Data, 2nd Edition. Cambridge, MA: MIT Press.

[30]. Yamane, T. (1967). Statistics, an introductory analysis, 2nd Ed. Harper and Row, New York.