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Analysis of Factors Determining Sesame Supply and Market Outlet choice Decision of Producers in East Wollega Zone, Oromiya Region, Ethiopia

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Abstract

Oilseeds such as sesame play a significant role on the lives of agrarian community and stakeholders in the national economy of the country as a whole. This study assessed determining factors of sesame supply and market outlet choice decision of producers in East Wollega zone using the data obtained from randomly selected 267 households. Both descriptive and econometric methods were employed for data analysis. Econometric result from a multiple linear regression showed that sesame supply is positively and significantly influenced by number of Oxen owned by households, land size allotted to sesame production, access to extension service and seed type used for production while negatively and Sgnificatntly influenced by access to credit and participation in non-farm activities. A result of multinomial logistic regression revealed that the likelihood of choosing cooperative outlet is positively and significantly affected by sex of household head, education level of household head, yield per hectare and use of fertilizer while negatively and significantly affected by access to credit and access to transport compared to traders at primary market. The result further showed that likelihood of choosing collector outlet is positively and significantly influenced by family size and land size allotted to sesame production whereas negatively and significantly influenced by age of household head, participation in non-farm activities, access to extension service and access to transport.Sesame producers need to practice using improved variety of sesame seed for production and focus on having more Oxen to boost quantity produced which in turn increase quantity supplied. Expanding equal accessibility of infrastructures such as road and transportation facilities needs government intervention to promote the effective marketing of sesame through all outlets.

Keywords: Sesame supply, market outlet choice, Multiple linear regression, multinomial logistic model, East Wollega

Introduction

Agriculture is the core component and driver for Ethiopia's growth and long-term food security as it directly employs 80 percent of the total population, 43 percent of gross domestic product (GDP), and over 70 percent of export value (UNDP 2013). Within Ethiopian agriculture, oilseeds are the most important export crop in terms of volume and almost on par with coffee in terms of export value. Pulses have always been important for the domestic market and are increasingly important for export incomes as well. Oilseeds play a significant role on the lives of the Ethiopian agrarian community and stakeholders in the national economy in Ethiopia (NABC 2015).

Sesame is an important oilseed crop grown for local consumption and export. Ethiopia is among the world's top five producers of sesame and the third largest world exporter of the crop (Wijnands*et al.* 2011). Oil crops are the second source of foreign exchange earnings next to coffee (FAO 2012) while sesame is the main oil seed in terms of production and marketing values. In 2010, Ethiopia was considered as the second main exporter of sesame seeds in the world, following India (FAOSTAT 2012). The many varieties of Ethiopian sesame seeds make it suitable for a wide range of applications. It is well suited for production in different countries due to its high flexibility to soil types and harsh environment. Sesame production and marketing has registered significant growth and the total area cultivated for this crop is also increasing (FAOSTAT 2012).

Oilseeds play a significant role on the lives of agrarian community and stakeholders in the national economy of Ethiopia. A variety of oilseeds are grown in Ethiopia, of which sesame is by far the most important both in terms of volume, value and export earnings (NABC 2015). According to Geremew (2012) promotion of export potential cash crop is crucial since it generates income for the producers as well as government for acquiring foreign currency. Ethiopia has a long history of sesame cultivation which has been expanding in its area coverage due to the presence of suitable agro-ecologies for the crop as well as the rise of profitability of the crop (MoA 2015). The main export markets for Ethiopia's sesame seed in 2008 were China, Israel, Turkey, and other countries in the Middle East. The price paid for Ethiopia's sesame seed is below world average because Ethiopia exports to countries that pay rather low prices (Wijnands et al. 2009). The demand for sesame seed is growing. The Chinese market

demand, presently Ethiopia's main export market for sesame seed, is also increasing rapidly (Wijnands et al. 2009).

Although agro-industry is the backbone of Ethiopian economy, the study by different scholars indicates that the sector faces many challenges due to limited market outlets, limited efforts in market linkage activities and poor market information among actors (Dereje 2007; Kaleb 2008; Dendena*et al*. 2009). Correspondingly, Mamo (2009) argued that small scale, dispersed and unorganized producers are unlikely to exploit market opportunities as they cannot attain the necessary economies of scale and lack bargaining power in negotiating prices. However, the majority of the studies on sesame mainly focused on production aspect of the crop and some have considered the common sesame production related problems, ignoring factors affecting sesame market outlet choice decisions at individual household level and its supply side problems. Hence, this study was devised to overcome the challenges of sesame supply and its market outlet choices, it deemed necessary to conduct statistical investigation at household level.

Materials and Methods:

The current study was conducted in East Wollega zone which is one of the zones of Oromia National Regional State. East Wollega zone comprises 17 districts and is characterized by three major agro ecologies include highland (13%), midland (57%), and lowland (30%) with hilly, undulating, and rolling topographical features. Its altitude ranges between 1000 and 2798 meters above sea level with the mean annual rainfall ranging between 1400 mm and 2200 mm. The main rainy season runs from the months of May to September. The soil types are clay and red sandy clay. Tef, barley, wheat, faba bean, sesame, groundnut, field pea, maize, sorghum, finger millet, potato, tomato, hot-pepper, and nug are some major crops grown in the zone (EWZFDOS 2018).

In order to draw representative sample for this current study, a multistage random sampling technique was used. At first stage three sesame producing woredas namely Laka Dullecha, Gida Ayana and Kiramu woredas were randomly selected. At second stage, two kebeles from each woreda were again selected by simple random sampling based on the effectiveness of cost of sampling. At third stage, households were selected from each selected kebeles by simple random sampling. The sample needed for this study was calculated using sample size determination for proportions. The procedure starts from calculating the initial sample size as follows.

$$n_0 = \frac{pq(Z_{\alpha/2})^2}{d^2} = \frac{(0.50 * 0.50)(1.96)^2}{(0.06)^2}$$

$$= 266.7$$

$$\approx 267 \quad (1)$$

Based on CSA and ICF (2007), the average household size of east Wollega zone is 4.75. Hence, by dividing the total number of population of the selected rural kebeles by the estimated household size (4.75), we can predict number of households for each kebeles. Following geometric growth model (Adem, 2009) $P_t = P_0[1 + r]^t$, we can forecast population of 2020 for each kebeles. Where, $P_t$is the population size at time t, P_0 is the initial population size, r is the population growth rate ($r = 2.9\%$ for Oromiya, CSA and ICF 2007), and t is length of time. Based on this principle, the projected population of the selected kebeles was sum to 8,317 households.

Since$\frac{n_0}{N}$, that is $\frac{267}{8317} = 0.032$ is less than 5 percent, the calculated sample size is satisfactory approximation of n. In this regard, p is set proxy to households having market information, $q = 1 - p$, $Z_{\frac{\alpha}{2}}$ is the value of standard normal distribution, d is margin of error, n is the required sample size and $N = 8{,}317$ is population size (Projected number of households for 2020 of the selected kebeles. For the analysis of primary data, both descriptive and econometric models were employed. Descriptive statistics such as the mean, standard deviation and percentages were used to characterize the sampled households along with sesame production and marketing. An Econometric model, multiple linear regression, was used to detect determining factors of sesame market supply. Multiple linear regression is a type of regression model which is used to describe and evaluate the relationship between continuous dependent variable and a set of two or more explanatory variables. Econometric specification of this model was adopted for this study and given as $y = X'\beta + U$ ere, y is a vector of observations on the explained variables, X is $n * (k + 1)$ matrix of observations on the explanatory variables including $x_1 =$ sex of household head, $x_2 =$ family size, $x_3 =$access to credit, $x_4 =$ number of Oxen owned by household, $x_5 =$ participation in non-farm activities, $x_6 =$ land size allotted to sesame production, $x_7 =$ access to extension service, $x_8 =$ cooperative membership, $x_9 =$ seed type for sesame production, $x_{10} =$ use of fertilizer, $x_{11} =$ yield per hectare, $x_{12} =$ access to market information and $x_{13} =$ distance from the nearest market, U is an $n * 1$ column

vector of errors and β is $(k+1)*1$ column vector of parameters to be estimated.

On the other hand, multinomial logistic model was applied to explore factors influencing market outlet choice decision of producers. Multinomial Logistic model works if a decision between multiple independent alternatives is truly made simultaneously. That is, alternative categories must be independent or mutually exclusive**.** This model was applied to explain inter household variation in the choice of a specific marketing outlet.

Assuming that the error terms are identically and independently distributed, the probability that household i choose market outlet j is explained by multinomial logistic model (Greene 2000).

$$P(y_i = {}^{j}/_{x_i}) = P_{ij} = \frac{\exp\left(x_i^{'\beta_j}\right)}{\sum_{j=1}^{n}\exp\left(x_i^{'\beta_j}\right)},$$

$$i = 1,2,3,\dots,n$$

$$j = 0,1,2,\dots,J \qquad (3)$$

Where, $P_{ij}$is the probability representing the i^{th}household chooses category j; $x_i$are predictors of probabilities; e is natural base logarithms; n is sample size and β_j are parameters to be estimated by maximum likelihood method. Following the generalized equation above, the multinomial logistic regression fitting to the present stud is adopted as:

$$P(y_i = {}^{j}/_{x_i}) = P_{ij} = \frac{\exp\left(x_i^{'\beta_j}\right)}{\sum_{j=1}^{3}\exp\left(x_i^{'\beta_j}\right)},$$

$$i = 1,3,3,\dots,267$$

$$j = 1,2,3 \qquad (4)$$

Where-, $j = 1$ for the household who decide to choose traders at primary market outlet, $j = 2$ for the household who decide to choose cooperative market outlet and $j = 3$ for the household who decide to choose collector market outlet, $x_i$are predictors (independent variables) and these include $x_1 =$ sex of household head, $x_2 =$age of household head, $x_3 =$ education level of household head, $x_4 =$ family size, $x_5 =$ Land size allotted to sesame production, $x_6 =$ number of Oxen owned by household, $x_7 =$ participation in non-farm activities, $x_8 =$cooperative membership, $x_9 =$ access to credit, $x_{10} =$ access to extension service, $x_{11} =$ access to transport, $x_{12} =$ distance from extension service, $x_{13} =$ distance from the nearest market, $x_{14} =$ access to market information, $x_{15} =$ yield per hectare, $x_{16} =$ use of fertilizer and $x_{18} =$ quantity of sesame marketed. An appropriate normalization that removes indeterminacy in the model is to assume that $\boldsymbol{\beta_1}$ (coefficients of explanatory variables on the reference

category, that is," traders at primary market") is equal to zero. Hence, the probability that traders at primary market was chosen can be expressed as:

$$P(y_i = {}^{1}/_{x_i}) = P_{i1} = \frac{1}{1 + \sum_{j=2}^{3} \exp(x_i'\beta_j)} \quad (5)$$

Where $\boldsymbol{\beta_2}$ and $\boldsymbol{\beta_3}$are coefficients of explanatory variables on the choices of cooperative and collectors outlets, respectively. Due to the fact that all must sum to one, the separate probabilities that the households' choices of cooperative and collectors outlet can be expressed by Equations (6) and (7), respectively as:

$$P(y_i = {}^{2}/_{x_i}) = P_{i2} = \frac{\exp(x_i'\beta_2)}{1 + \sum_{j=2}^{3} \exp(x_i'\beta_j)} \quad (6)$$

$$P(y_i = {}^{3}/_{x_i}) = P_{i3} = \frac{\exp(x_i'\beta_3)}{1 + \sum_{j=2}^{3} \exp(x_i'\beta_j)} \quad (7)$$

The parameter estimates of the MNL model only provide the direction of the effect of the independent variables on the dependent variables. Thus, the estimates represent neither the actual magnitude of change nor the probabilities. Instead, the marginal effects are used to measure the expected change in probability of a particular technique being chosen with respect to a unit change in an independent variable from the mean (Greene 2000).

Results and Discussion

Descriptive results

Tables 1 presents general characteristics of the sampled respondents based on the categorical and/or binary variables. The total sample size of respondents handled during the survey was 267 sesame producers. Of the total sampled respondents, 224 (83.9%) were male-headed households and 43 (16.1%) were female-headed. The distribution of marital status shows that out of the total samples, 212 (79.4%), 45 (16.9%), 6 (2.2%) and 4 (1.5%) were married, single, divorced and widowed household heads, respectively. Majority of the households (130 or 48.7%) have no formal education while 112 (41.9%) of them attended up to primary education. Households those who attended secondary and higher education account 9 (3.4%) and 16 (6.0%) of total surveyed sample, respectively. Access to financial resources, information and social networks are crucial aspects to determine production and marketing potential of sesame producers. Respondents are asked whether they have credit access or not and accordingly majority (164 or 61.4%) of them reported that they do not have this basic access. Extension service

is moderately expanded as the result revealed that 171 (64.1%) of the respondents get the access. Transportation access is another important factor of sesame marketing and accordingly 212 (79.4%) of the respondents reported that they have the access. To some extent, majority of the respondents participate in non-farm income generating activities and account for 160 (59.9%) of the surveyed sample. Information is very important tool to decide where to sell output of the product and to choice among market outlets which provide better price. Following this 246 (96.1%) of the respondents reported that they have access to market information.

Technology adoption is very crucial in order to increase the production and productivity of crops. In line with this idea, respondents were asked about the status of technology adoption by giving emphasis on the use of fertilizer, type of sesame seed used for production and use of row sowing/planting. Accordingly, only 99 (37.1%) of the respondents were using fertilizer for the production of sesame whereas the majority, 168 or (62.9%), of them were not using fertilizer. Majority of the respondents did not exercise the use of improved sesame seed for the production and accordingly, only 70 (26.30%) of them were using improved seed while 197 (73.70%) of them were using traditional seed. Row sowing/planting determines the quantity of output to be produced as it has been confirmed to yield satisfactory quantity if applied properly. Following this, 130 (48.70%) know that row sowing/planting will increase productivity while the rest 137 (51.30%) of them do not know the concept and have never applied. One can observe from this result that the production of sesame in the study area is not so much appreciable due to poor adoption of agricultural technology. The maximum amount of output obtained from one hectare of land is 10 quintal as can be seen from the presented result below which is very poor. With proper adoption of modern technology, one can increase the production and productivity of sesame at large scale. Regarding the sesame marketing outlet, 41.6%, 37.1% and 21.3% of the respondents reported that they mostly choose traders at primary market, cooperatives and collector outlets, respectively. Majority of the respondents, 158 or (59.2%), were engaged in rural cooperative membership. A widely used sesame market outlet in the study area is traders at primary market outlet. This may due to the reason that farmers can find best option which offer high price by comparing

between individual traders in the market(Table 1).

Table 1: General characteristics of sesame producers (Categorical/binary variables)

Variable	Item	N	No. of households	Percent
Sex of Household head	Male	267	224	83.9
	Female		43	16.1
Marital status	Married	267	212	79.4
	Single		45	16.9
	Divorced		6	2.2
	Widowed		4	1.5
Education Level	No education	267	130	48.7
	Primary		112	41.9
	Secondary		9	3.4
	Higher		16	6.0
Access to credit	Yes	267	103	38.6
	No		164	61.4
Access to extension	Yes	267	171	64.1
	No		96	35.9
Access to transport	Yes	267	212	79.4
	No		52	19.5
Participation in non-farm	Yes	267	160	59.9
income activities	No		107	40.1
Access to information	Yes	267	246	92.1
	No		21	7.9
Using fertilizer	Yes	267	99	37.10
	No		168	62.90
Type of sesame seed used	Traditional	267	197	73.7 0
	Improved		70	26.30
Row sowing/planting	Yes	267	130	48.70
increase productivity?	No		137	51.30
Cooperative membership	Yes	267	158	59.20
	No		109	40.8
Which market outlet do	Primary market		111	41.6
you mostly choose?	Cooperatives	267	99	37.1
	Collectors		57	21.3

Source: Computed from survey (2020)

Tables 2 presents general characteristics of the sampled respondents based on the continuous variables. The average age of the sampled respondents was 40.30 with standard deviation of 9.90. The average household size of the total sample respondents was found to be 5.53 with standard deviation of 2.20. Dependency ratio is found to be 97.91 with standard deviation of 81.80. This result implies that

number of dependents in the family is less than number of independents (14-64 years old). In order to arrive at the nearest market, on average, one needs to walk around 52.73 minutes while arriving at the extension service needs 55.10 minutes' walk on average (Table 2). It is believed that access to physical and natural resource determine the status of sesame production. In the study area, the average land size owned by household is 3.93 hectare with standard deviation of 1.46. Of these land holding size, on average 1.60 hectare with standard deviation of 0.86 is suitable for the production of sesame. The maximum number of Oxen owned by household is 6 whereas the average is found to be nearly 3 Oxen with standard deviation of 1.46. However, there are individuals who do not have any Oxen and they rent from others for the ploughing of land. The result of this study further revealed that 5.20 quintal of sesame output is obtained on average from on hectare of land while to the maximum, 10 quintal can be obtained. Prior to the survey year, the mean of sesame production per household was 15.10 quintal which quite high with the standard deviation of 10.33. Of this quantity, the average quantity of sesame sold per household was found to be 12.92 quintal with standard deviation of 8.83. The maximum quantity sold per household was 40 quintal of sesame output (Table 2).

Table 2: General characteristics of sesame producers (continuous variables)

Variable	N	Min.	Max.	Mean	Std. dev.
Age of household head (Year)	267	19	80	40.30	9.90
Family size (Number)	267	1	14	5.53	2.20
Dependency ratio	267	0	400	97.91	81.80
Distance to the nearest market (Minute)	267	10	13.00	52.73	32.62
Distance to extension service (Minute)	267	5.00	120.00	55.10	30.41
Land holding size (Hectare)	267	0.50	6.00	3.93	1.46
Suitable land for sesame (Hectare)	267	0.25	4.50	1.60	0.86
Number of oxen owned (Number)	267	0.00	6	2.88	1.46
Amount of sesame per hectare (Quintal)	267	3.00	10.00	5.20	1.77
Quantity produced in 2020 (Quintal)	267	3.50	45.00	15.10	10.33
Quantity sold 2020 (Quintal)	267	2.00	40.00	12.92	8.83

Source: Computed from survey (2020)

Econometric Results

Determinants of sesame market supply

As detailed in the methodology section, ordinary least square estimation (OLS) of multiple linear regression model was used to detect determinants of sesame supply. Prior to run OLS estimation, variables were checked for estimation problems such multicollinearity and hetroscedasticity as they are highly expected while using OLS estimation. The F-statistics (F = 11.00) as indicated by significant P-value (P = 0.00) reveals that the model has strong explanatory power. Variance inflation factor (VIF) is computed for each explanatory variable to check the existence of multicollinearity. The values of VIF were found to be less than 10 confirming that the model is free of this problem. The result of coefficient of multiple determination (R^2 = 96.10%) showed that 96.10% of sesame market supply is explained by the significant variables under consideration. In order to assess determining factors of household level sesame supply to the market, thirteen variables were entered as predictor variables and six of them were found to be statistically significant. Those significant variables include access to credit, number of Oxen owned, participation in nonfarm activities, Land size allotted to sesame production, access to extension service, and seed type used for sesame production (Table 3). The possible interpretation and discussion of the significant variable were given as follows:

Access to credit negatively and significantly affected market supply of sesame. In reality, if households have access to credit service, they can have sufficient finance to pay for seasonal labor and to buy agricultural inputs, thereby increasing amount of production which is reflected in the market supply of sesame. However, the result obtained here is opposite to this reality and it confirms that as households use credit access, the amount of sesame supply decreases by 2.02 percent compared to credit non-user households. The reason behind could be that majority of the sampled households may use the credit activities such as starting trade, buying livestock than Oxen, building house and the like other than using for the production of sesame. The result obtained is in line with the result by Girmalem et al (2019).

Number of Oxen owned by households positively and significantly affected sesame supply. The result depicted that as the number

of oxen increases by one, the market supply of sesame increases by 4.45 quintal. The implication of this result is that since majority of the farmers use traditional way of farming system having their own Oxen may highly determine their sesame production status. That is, farmers who own higher number of Oxen can produce more sesame output which increases marketable surplus. The result obtained is in line with finding of Edosa (2018) who found that ownership of Oxen increases teff market supply.

Participation in non-farm activities is another crucial determining factor of sesame supply and it found to be negative and significant factor of household level sesame supply. The result of this study conveyed that as household participation in non-farm activities Increases, the sesame market supply decreases by 4.45 percent. That is, farmers those who do not participate in non-farm activities supply more sesame than those farmers who participate in non-farm activities. The concentration of the households who participate on non-farm activities is always searching non-farm activities which generate income for their livelihood and they may be late for farming sector activities.

Land size allotted to sesame production positively and significantly influenced sesame market supply. The result depicted that as land size allotted to sesame production increases by one hectare, the sesame market supply increases by 6.02 quintal. The implication of this result is that specialization in sesame production increases the marketable surplus as it increases the productivity of sesame. Similarly, Dagnaygebaw (2018) indicated that the area of land allocated to sesame production significantly and positively affected farm level market supply(Table 3).

Table 3: *OLS* estimation of multiple linear regression model

Variables	$\boldsymbol{\beta}$	$\boldsymbol{SE(\beta)}$	$\boldsymbol{t}$	$\boldsymbol{P}$	**VIF**
Dependent variable: Quantity of sesame supplied (Quintal)					
Independent variables					
Sex of household head (1 = Male)	0.58	1.26	0.46	0.645	1.09
Family size (number)	0.05	0.25	0.19	0.849	1.14
Access to Credit (1 = Yes)	-2.02	1.02	-1.98	0.049	1.27
Number of Oxen owned (Number)	4.62	1.37	3.37	0.072	1.48
Participation in non-farm activities (1 = Yes)	-4.45	1.05	-4.22	0.000	1.35
Land allotted to sesame production (Hectare)	6.02	0.59	10.20	0.083	1.27
Access to extension service (1 = Yes)	1.82	0.99	1.82	0.070	1.29

Cooperative membership (1 = Yes)	-1.53	1.10	-1.38	0.168	1.52
Seed type for sesame production (1 = Improved)	5.64	1.14	4.95	0.000	1.29
Using fertilizer (1 = Yes)	-0.27	1.10	-0.24	0.807	1.41
Yield per hectare (Quintal)	-0.31	0.27	-1.14	0.254	1.12
Access to market information (1 = Yes)	1.68	1.73	0.97	0.332	1.11
Distance from the nearest marker (Minute)	-0.01	0.01	-0.92	0.360	1.20
Constant	14.23	2.74	5.19	0.000	
Significance levels: 1, 5 and 10%					
N = 267 F(13, 253) = 11.00 Prob> F = 0.000 R^2 = 0.9610, R^2(adj) = 0.9282					

Source: Computed from survey (2020)

A**ccess to extension service** positively and significantly influenced quantity of sesame supplied to market. A farmer having access to extension service increases quantity of sesame supply by 1.82 percent. This indicates as similar finding with Yimer (2015), the aim of the extension service is introducing farmers with new and improved agricultural inputs for better methods of increasing production and productivity in turn increase marketable supply. This indicates that access to extension service avails information regarding technology which improves production that affects the marketable surplus.

Seed type for sesame production is another important determinant of sesame market supply. This variable positively and significantly influenced quantity of sesame supply. The result suggested that a farmer using improved sesame seed for production increases sesame market supply by 5.64 quintals compared to a farmer using traditional type of sesame seed for production. This finding is in line with the study by Abayneh (2018) who found that the use of improved variety of cotton increases cotton supply(Table 3).

Determinants of sesame market outlet choice decision

Multinomial logistic model was used to assess determining factors of sesame market outlet choice decision of producers. Multinomial logistic model with three choices (Traders at primary market, Cooperatives and Collectors) was tested for the independence of irrelevant alternatives (IIA) assumption based on Hausman specification test in STATA version 11. The result showed that access to transport was significant at both marketing outlet (Cooperatives and Collectors). Compared to the base category (Traders at primary market), sex of household head, education

level of household head, access to credit, access to transport, yield of sesame and use of fertilizer were significant determinant of households' decision to select cooperatives market outlet.

On the other hand, age of household head, family size, land allotted to sesame production, participation in non-farm activities, access to extension service and access to transportation were significant determinant of households' decision to select collectors market outlet compared to the base category. The positive estimated coefficients of a variable indicates that the probability of the producers being in either supplying to cooperative market outlet or collector market outlet relative to supplying to traders at primary market outlet increases as those explanatory variables increase. The implication is that the probability that producers select these outcomes (Cooperatives and Collectors) is greater than their probability of selecting base outcome. The negative and significant parameter indicates the probability of selecting traders at primary market outlet is higher than the probability of selecting either cooperatives or collectors outlet.

Estimates not significantly different from zero indicate that the explanatory variable concerned does not affect the probability of the producers' decision to use base category than in the other two categories. The signs of the coefficients of multinomial logistic regression were presented in Table 4. The parameter estimates of the multinomial logistic model only provide the direction of the effect of the independent variables on the dependent variables. Thus, the estimates represent neither the actual magnitude of change nor the probabilities. Instead, the marginal effects are used to measure the expected change in the probability of a particular technique being chosen with respect to a unit change in an independent variable from the mean. Marginal effects of logistic regression were presented in Table 5 and their possible discussion follows.

Sex of household head positively and significantly influenced the decision of households to select cooperative outlet. The result of marginal effect shows that being male headed household increases the likelihood of the choice of cooperative outlet by 17.9% as compared to choosing traders at primary market keeping other variables constant. Male headed households are expected to have higher effort than female headed in diversifying their production and even can withstand production challenges than their counterparts. The result obtained is in line with the finding of Jima and Kumilachew

(2020) who found that Sex of the household head positively influenced the likelihood of choosing a wholesaler coffee market outlet.

Age of household head negatively and significantly influenced households' decision to choose collector outlet. Holding other variables constant, as the age of a household increases by one year, the probability of choosing collector outlet decreases by 0.6% implying sesame producing farmers sell more output to traders at primary markets (the base category). This is contradictory with the finding by Nasir (2020) who found that age of household positively affected collector coffee market outlet. He argued that aged households are weak and unable to go far market center which put their choice on using the one available nearby.

Education level of household head is another positive and significant determinant of households' decision to select cooperative outlet. As indicated by the marginal effect, having formal education increases the likelihood of choosing cooperative outlet by 9.2% compared to the choice of traders at primary market keeping other things constant. This is because spending more years in formal education makes producers better to recognize profits/benefits from selling through different market outlets and become wise in the choice of best outlets. Hence, educational level of households is considered as an important factor to participate actively in different outlets. The result obtained here is in line with the finding by Yonnas et al (2019) who found positive impact of education level of household head on the likelihood of choosing wholesalers' and consumers' market outlet choices.

Family size per household positively and negatively influenced collector market outlet. Marginal effect result depicted that as family size increases, the likelihood of choosing collector outlet increases by 3.8% compared to traders at primary market being other things remain constant. Households with larger family size are more likely to choose collector market outlet rather they prefer to supply to either cooperatives and or traders at primary market outlets. The result obtained here is contradictory with the finding by Yonnas (2019) who found negative impact of family size on the choice of wholesaler outlet for wheat marketing.

Land allotted to sesame production positively and significantly influenced households' decision to choose collector sesame market outlet. The result from marginal effect conveyed that as land allotted to sesame production increases by one hectare, the likelihood of choosing collector outlet increases by 5.9% compared to traders at primary market being other

things remain constant. This means a household who has one hectare more land allotted to sesame production has more probability to choose collector outlet than traders at primary market and cooperative outlets.

Participation in non-farm activities negatively and significantly influenced households' decision to choose collector outlet to sell their sesame product. The result further depicts that participation in non-farm activities decreases the likelihood of choosing collector outlet by 14.5% compared to choosing traders at primary market, being other things constant. This indicates that farmers who are involved in off-farm activities are less likely to send their sesame to cooperative and collector outlets compared to traders at primary market.

Access to credit negatively and significantly influenced households' decision to choose cooperative outlet compared traders at primary market. This means, sesame producers were more likely to choose traders at primary market outlet than any other outlets under consideration. One of the reasons for accessing credit is to recruit a transportation facility to supply sesame to the market. Farmers who have access to formal credit have more possibility to choose their sesame market outlet than those who have no access to formal credit. Sometimes, access to credit is determined by the availability of cash on hand. The finding of marginal effect depicts that, other things being constant, getting access to formal credit decreases the likelihood of choosing cooperative outlet by 21.2% compared to traders at primary market outlet. The implication is that if a farmer has access to credit he or she can easily access a transportation facility that assists in having a greater depth of market choice. The result obtained is contradictory to the result obtained by Mekonin (2017) who found a positive e influence of access to credit on the end consumer coffee market outlet.

Access to extension service negatively and significantly affected households' decision to choose collector market outlet. Being other things constant, having access to extension service decreases the likelihood of choosing collector outlet by 6.8% compared to choosing traders at primary market outlet. Households who have an access to extension service would sell their sesame product to traders at primary market outlet than farmers who did not have access to extension service. This implies that extension service increased ability of farmers to improve production and market information, thereby increasing output and ability to choose the best market

outlet which gives high price. This result is consistent with Abraham (2013) who found that extension service affect choice of collector and retailer market outlet negatively.

Transportation access negatively and significantly affected the choice of both cooperative and collector outlets. The marginal effects depict that having any form of transportation facility Decreases the likelihood of choosing cooperative and collector outlets by 14.5% and 9.1%, respectively, compared to traders at primary market outlet, given that other things are constant. This can be attributed to the fact that those who do not have their own transportation facility were unable to travel further distances in order to sell their Sesame to markets that offer higher prices than the traders at primary market outlets. The availability of a transportation facility offers greater depth in choosing a market. This result is contradictory with Abraham (2013) who found that owning a transportation facility had a positive influence on the choice of a collector outlet compared to a wholesale outlet in the marketing of vegetables.

Sesame yield per hectare positively and significantly influence households' decision to choose cooperative outlet. The marginal effect depicts that the amount of sesame yield obtained from one hectare increases the likelihood of choosing cooperative outlet by 3.22% compared to choosing traders at primary market keeping other things constant. If the quantity produced is large, farmers are forced to search a market outlet which buys their product with cost effective and benefits. The result obtained here is in line the finding of Taye et al (2018) who found that an increase in farmer's onion yield results in an increase in the probability of choosing assembler market channel.

Use of fertilizer positively and significantly influenced households' decision to choose cooperatives outlet. Marginal effect of this variable conveyed that a household uses fertilizer for the production of sesame, the likelihood of choosing cooperative outlet increases by 30.1% compared to the choice of traders at primary market outlet being other things remain the same. This may be due to the reason that farmers can get access of fertilizer from cooperatives at cost effective and apply to their production of sesame. Hence, a household who uses fertilizer has possibility of choosing cooperative outlet than any other marketing outlets.

Table 4: *Parameter estimation (coefficients) of Multinomial logistic regression*

Chosen Market outlet								
Independent variables	**Cooperatives**				**Local buyers (Collectors)**			
	β	**robust SE(β)**	**Z**	**P**	**β**	**robust SE(β)**	**Z**	**P**
Sex of household head (1 = Male)	0.908	0.447	2.03	0.042	0.468	0.507	0.92	0.356
Age of household head (Years)	-0.013	0.019	-0.66	0.512	-0.046	0.023	-1.97	0.049
Education Level of household head (Formal)	0.426	0.219	1.94	0.052	0.097	0.255	0.38	0.703
Family size (number)	0.007	0.082	0.09	0.931	0.251	0.093	2.71	0.007
Land allotted to sesame production (Hectare)	-0.149	0.128	-1.17	0.243	0.319	0.148	2.16	0.031
Number of Oxen owned (Number)	0.043	0.138	0.31	0.754	-0.131	0.157	-0.84	0.401
Participation in non-farm activities (1 = yes)	-0.266	0.382	-0.70	0.486	-1.074	0.495	-2.17	0.030
Cooperative membership (1 = yes)	0.000	0.0397	-0.00	0.999	0.139	0.439	0.32	0.752
Access to credit (1 = yes)	-0.934	0.382	-2.45	0.014	-0.078	0.427	-0.18	0.855
Access to extension service (1 = yes)	-0.552	0.363	-1.52	0.128	-0.700	0.414	-1.69	0.090
Access to transport (1 = yes)	-0.923	0.418	-2.21	0.027	-1.015	0.540	-1.88	0.060
Distance from extension service (Minute)	-0.001	0.006	-0.08	0.936	0.007	0.006	1.23	0.220
Distance from the nearest market (Minute)	0.008	0.005	1.46	0.145	-0.008	0.006	-1.24	0.216
Access to market information (1 = yes)	0.589	0.624	0.94	0.345	1.006	0.670	1.50	0.133
Sesame yield per hectare (Quintal)	0.177	0.093	1.90	0.057	0.129	0.105	1.23	0.219
Using fertilizer (1 = yes)	1.326	0.378	3.51	0.000	0.104	0.476	0.22	0.827
Quantity of sesame marketed (Quintal)	0.004	0.021	0.210	0.834	-0.012	0.023	-0.52	0.604
Constant	-1.086	2.031	-0.53	0.593	-0.106	2.474	-0.04	0.966
Traders at primary market (Base outcome), Significance levels: 1, 5 and 10%, N = 267 LR Chi-square = 105.89 Prob> Chi^2 = 0.000 Pseudo R^2 = 0.187 Log likelihood = -230.725								

Source: Computed from survey (2020

Table 1: ***Marginal effect of multinomial logistic regression***

Chosen Market outlet								
Independent variables	**Cooperatives**				**Local buyers (Collectors)**			
	$\mathbf{d}_y/d_x$	**SE**	**Z**	**P**	$\mathbf{d}_y/d_x$	**SE**	**Z**	**P**
Sex of household head (1 = Male)	0.009	0.685	1.92	0.055	0.009	0.069	0.13	0.899
Age of household head (Years)	0.001	0.004	0.05	0.959	-0.006	0.003	-1.91	0.056
Education Level of household head (Formal)	0.092	0.046	2.01	0.045	-0.014	0.034	-0.42	0.675
Family size (Number)	-0.016	0.018	-0.89	0.372	0.038	0.013	2.99	0.003
Land allotted to sesame production (Hectare)	-0.057	0.027	-2.08	0.037	0.059	0.021	2.86	0.004
Number of Oxen owned (Number)	0.019	0.029	0.65	0.515	-0.023	0.022	-1.06	0.290
Participation in non-farm activities (1 = yes)	0.012	0.083	0.15	0.885	-0.145	0.068	-2.12	0.034
Cooperative membership (1 = yes)	-0.010	0.086	-0.11	0.910	0.021	0.061	0.34	0.731
Access to credit (1 = yes)	-0.212	0.081	-2.61	0.009	0.052	0.059	0.89	0.375
Access to extension service (1 = yes)	-0.080	0.078	-1.02	0.306	-0.068	0.0578	-1.19	0.236
Access to transport (1 = yes)	-0.145	0.094	-1.55	0.122	-0.091	0.078	-1.16	0.247
Distance from extension service (Minute)	-0.001	0.001	-0.49	0.628	0.001	0.001	1.37	0.172
Distance from the nearest market (Minute)	0.002	0.001	2.07	0.039	-0.002	0.001	-1.94	0.052
Access to market information (1 = yes)	0.068	0.128	0.53	0.597	0.112	0.088	1.27	0.203
Sesame yield per hectare (Quintal)	0.032	0.020	1.64	0.100	0.007	0.014	0.52	0.606
Using fertilizer (1 = yes)	0.301	0.080	3.75	0.000	-0.075	0.066	-1.14	0.253
Quantity marketed (Quintal)	0.002	0.005	0.41	0.679	-0.002	0.003	-0.66	0.511
Traders at primary market (Base outcome)		**Significance levels: 1, 5 and 10%**			$\mathbf{d}_y/d_x$**= marginal effect**			

Source: Computed from survey (2020

Conclusion and Recommendation

Conclusion

Based on literature and findings of this current study, marketable supply of the oilseed commodities has been recognized as basic source of income of smallholder farmers which helps them to improve their daily livelihood in particular and hence boost economic development in general. The purpose of this study was generally to pinpoint major factors determining sesame supply and market outlet choice decision of producers. The result of multiple linear regression revealed that number of oxen, land size allotted to sesame production, access to extension service and seed type used for production were found to have positive influence on the quantity of sesame supplied to the market. These factors are very crucial to improve both quantity and quality of farm produce to sustain competitiveness and improve the livelihood of farmers. On the other hand, access to credit and participation in non-farm activities were negatively related to the quantity of sesame supply. The result from multinomial logistic regression depicted that the likelihood of choosing cooperative outlet increases with increase in education level of household head, sesame yield per hectare and using fertilizer compared to the choice of traders at primary market. Male headed households have higher probability to choose cooperative outlet than their counter parts. Having access to credit and access to transport decreases the likelihood of choosing cooperative outlet than traders at primary market outlet. The likelihood of choosing collector outlet increases with the increase in family size and land size allotted to sesame production compared to traders at primary market outlet while age of household head, participation in non-farm activities, access to extension service and access to transport decreases the likelihood of choosing collector outlet compared to traders at primary market. A farmer who has access to transport has higher probability to choose traders at primary market than choosing both cooperative and collector outlets. Traders at primary market is the best option outlet for sesame producers since it has marketing freedom in a sense that farmers can choose to sell their sesame at a time they need.

Recommendations

The following recommendations or policy implications were drawn from the finding of the study based on the significant variables.

- Sesame producers need to practice using improved variety of sesame seed for production and focus on

having more Oxen to boost quantity produced which in turn increase quantity supplied.

- Expanding equal accessibility of infrastructures such as road and transportation facilities needs government intervention to promote the effective marketing of sesame through all outlets.
- It is good if the government provide long term loans for the farmers which enable them to access agricultural inputs which promote the quantity of output and manage their sesame marketing and/or production more effectively.
- Households should seek other means of generating income in addition to sesame production to diversify their annual total income in which they can improve their livelihood status.
- Local authority should be able to schedule area specific and efficient extension service in order to increase awareness of the producers regarding production and marketing of sesame.
- Lastly, extension agents should increase the understanding of households about the importance of agricultural inputs such as improved sesame seed and the concerned authority should be able to increase its accessibility with cost effective.

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