Analysis of Smallholder Farmer's Participation in Sesame Production and Commercialization in Southern Ethiopia

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Abstract

This study aims at analyzing factors influencing smallholder farmers' decision to produce sesame for the export market in Kamba district of Game zone in southern Ethiopia. Primary data were collected from 380 sesame producing smallholder farmers. Descriptive statistics and double hurdle model were applied for the analysis. The result revealed that age, sex, farm size, off-farm income, level of education and distance to nearest market center have influenced the decision to participate in sesame production for export market while age, family and farm sizes, level of education, distance to close market center and access to market information have affected the extent of sesame export market supply. The study recommended that the government should enhance export volume of sesame production through implementing gender mainstreaming programs, encouraging participation in off-farm income activities, provision of non-formal education programs, land intensification techniques, promoting family planning programs and establishing near market information provision centers in the study area.

Key words: smallholder farmers, sesame export market, double-hurdle model, southern Ethiopia

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Introduction

Agriculture remains the main pillar of Ethiopia's economy, accounting to about 41 percent of the total Gross Domestic Product (GDP), 85 percent of the total export earnings and contributes 70 percent of raw materials to industries and 85 percent of country's employment (MoFED, 2016). Its sound performance warrants the availability of food supplies for future growing populations of the country. In this regard, collective efforts have been taken by government and non-governmental organizations towards securing agricultural outputs, particularly on export item crops over the last years. However, achievement in the agricultural sector does not warrant self-adequate acquisition of food crops for conquering either the prevalence of food insecurity or narrowing the export gaps for the country.

In Ethiopia, smallholder farmers hold the lion's share of total cultivated areas as compared to large farmers with the exception of tea, sugarcane and flowers (CSA, 2017). About 11.7 million smallholder households account 95 percent of the total agricultural contribution to Growth Gross Domestic Product (GDP) (WB, 2017). In views of this, a considerable effort has been taken by government through designing various specific programs that aim at the intensification of high value marketable export crops and enhancing their production in different parts of the country (MoFED, 2016). In this regard, the five-year development plan of Ethiopia of which the Growth Transformation Plan II also gave much emphasis to align smallholder farmers' production with export market via providing various supports by organizing farmer unions and/or cooperatives in their villages. In addition, the plan gave much emphasis to encourage large-scale sesame producing farmers' efforts to strengthen sesame oil seed processing industries in different parts of the country (MoFED, 2010).

Ethiopia has been exporting sesame to the world market over the last recent years. It is cultivated by small- and large-scale farmers as one of the major commercial export crop items in different parts of the country such as *Humera* area in *Tigray*, *Metema* and *Wollo* areas of the *Amhara*, in some areas of *Somilia*, *Chanka* area in *Wellega* of *Oromiya,* in *Pawi* areas in *Benshangul Gumuz* region, and in *Kamba* areas of the Southern Nation Nationalities People (SNNP) region of Ethiopia (FAO, 2015; CSA, 2017). Moreover, the county has a considerable potential of arable land and a huge demand for sesame from both local and international markets. Therefore, given such production potential and market opportunity, the country should provide adequate attention to the improvement of sesame production and market performance so that it can contribute positively to the socio-economic development endeavor of the nation.

Sesame production, which is mostly for international export market is one of the important oil-seed export crops in Ethiopia (Wijnands *et al*., 2007). In 2016/17, the total production of sesame reached 327,741 tons; total harvested area of land was estimated at 293,645 hectares; and its productivity was 7,873 quintals per hectares (FAOSTAT, 2018). In SNNP region, particularly in *Kamba* district of *Gamo* zone, sesame is one of the major cash crops produced dominantly by smallholder farmers for local and export market. According to *Kamba* District Agricultural and Rural Development Office, in 2018/19, the average productivity of sesame crop reached to 6.5 quintals per hectare, which was lower than the national average yield but higher than the average yield of SNNP region, i.e., 0.497 quintals per hectare in 2014/15 (Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), 2018; Abadi, 2018). The lower productivity of sesame in the region, compared to the national average might be due to one of several factors.

Previous empirical studies on sesame in Ethiopia such as Abadi (2018), Negash (2017), Mesfin and Babu (2018) and Zerihun (2012) attested variables such as drought, mono-cropping practice, incidence of weeds and insect in the smallholder farming system are the key challenges and opportunities of marketing. Lack of varieties which respond to inorganic fertilizers, lack of knowledge of post-harvest crop management, and lack of high-level oil processing industries are the major challenges, while suitability of land or agro-ecology, demand from domestic and international market, creation of employment opportunity for rural youth, availabilities of credit, and the use of pharmaceutical ingredients are the opportunities of sesame production in the country. On the other hand, a study by Adugna *et al.* (2019) and Ermiyas *et al.* (2015) focused on efficiency analysis of sesame in Ethiopia; they remarked that enhancement of production and productivity of sesame among smallholder farmers could be made through improving their efficiencies. Moreover, other empirical studies in Ethiopia focused on sesame market chain analysis were studied by Dagnaygebaw *et al*. (2018), Fikru *et al*. (2017), and Geremew (2012). However, studies on the factors influencing status and extents of sesame production for export market supply via farmer unions and/or farmer cooperatives (export market orientation) among smallholder farmers are limited in Ethiopia.

Therefore, this study aims at providing knowledge-based information for policy makers so as to rectify the constraints of sesame marketing among smallholder farmers in *Kamba* district of *Game* zone of southern Ethiopia.

Material and Methods

Description of the Study Area

Kamba district is one of the sesame growing areas found in *Gamo* zone of Southern Nation Nationalities People (SNNP) regions. According to the information from the District Agriculture Office and CSA (2013) report on population projection, *Kamba* is one of the 15 districts of the zone. It has 39 rural *Kebeles* (lowest administration unit) and 4 municipality centers with total population of 222,301 of which 12.3% live in urban and the remaining, in the rural areas.

Data Type, Source and Methods of Collections

Both qualitative and quantitative data were collected using primary and secondary data sources. The data from primary sources were collected from sampled farm household heads using structured questionnaire, key interview and focus group discussion, while secondary data were collected from various published documents.

Sampling Techniques

The study employed multi-stage techniques. In the 1st stage, the study selected 11 *Kebeles* from 39 *Kebeles* and included for the study. In the 2nd stage, 380 household heads were selected using random sampling method proportion to their total population. The study applied Yemane (1967) statistical formula to determine representative sample size with 95% confidence interval and 5% level of precision.

Method of Data Analysis

To analyze the data, descriptive statistical techniques and econometric model were used. Descriptive statistical techniques such as measure central tendency, measures dispersion and t and chi-square testes were used while double hurdle econometrics model was applied. Details of justification and specification are provided below:

In this study, the decisions on whether or not to participate in sesame export market and the intensity of participation to export market in quintal may not be influenced jointly by same factors. Double-hurdle model and Tobit model were applied but the latter might be applied if both are inflected simultaneously by the same factors (Tobin, 1958). Besides, in this research, farmers produce sesame mostly for local or export market and hence there is no truncated distribution of observations in the data set. However, the selection of the right model for the study should be decided after conducting the log-likelihood value test which was/is carried out with a separate estimation of Probit and truncated regression models. In this study, the empirical test deemed double-hurdle model and hence independently modeled. The model is originally developed by Cragg (1971) and following Greene (2012), sequentially specified below:

In the 1st step(s) of double-hurdle binary Probit model are applied and the specification are given as:

$$Y_i^* = \beta_i X_i + \varepsilon_i \tag{1}$$

$$Y_i^* = \begin{cases} 1, & If \ Y^* \geq 0 \\ o, & If \ Y^* \leq 0 \end{cases} \tag{2}$$

Where Y_i^* is participation decision to sesame production to export market (export market orientation) by the ith smallholder farmers, X_i is a vector of explanatory variables and ε_i is normally distributed error term with zero mean and constant variance, i = 1, 2, … n (n is the number of observations), β_i is vector of unknown parameters. In this study, a smallholder is export market-oriented if the farmers sold 70% of the total amount of sesame produce to export market via farmer unions and/or cooperatives.

2nd steps of double-hurdle model, the truncated model which is similar with Tobit model and applied to determine the factors influencing extent of sesame export market supply via farmer unions and/or cooperatives by smallholder farmers. This model excludes farmers who did not participate on the export market-based value of the dependent variable and uses only the observations that reported positive and greater zero and specified as:

$$Y_i^* = \beta_i X_i + \varepsilon_i \tag{3}$$

$$Y_i^* = \begin{cases} 1, & \text{If } Y_i^* = 1 \quad \text{and} \quad Y_i^* \geq \mu \\ 0, & \text{If } Y_i^* \leq 0 \quad \text{and} \quad Y_i^* < \mu \end{cases} \tag{4}$$

Where Y_i^* is volume of export market supply of sesame or is the extent of participation on export market in quintal by the ith smallholder farmers, β_i is vector of unknown parameters, X_i is a vector of explanatory variables, ε_i is normally distributed error term with μ representing level of participation on export sesame market in quintal and i = 1, 2, … n (n is the number of observations)

The double-hurdle model relies on strong assumption of independently and normality of both error terms with mean zero, constant variances and the covariance between then are also equal to zero.

The log-likelihood function of double-hurdle model is given by

$$Log = \sum_0 ln\left[1 - \phi\alpha Z_i\left(\frac{\beta X_i}{\sigma}\right)\right] + \sum_+ Ln\left[\phi\alpha Z_i\frac{1}{\sigma}\Phi\left(\frac{Y_i-\beta X_i}{\sigma}\right)\right] \quad (6)$$

The first portion of the above equation is the log-likelihood of Probit model, while the second portion is the log-likelihood for a truncated regression, where Φ represents the standard normal cumulative density function. Explanatory variables, their measurement, descriptive statistics and hypothesis used in the analyses are summarized in Table 1 below.

Table 1. Summary of variables, descriptive statistics, measurements and their hypotheses

Variables	Measurements	Descriptive statistics		Hypotheses	
		Mean (Std)/ Freq (%)		Participation	Market supply
Demographic characteristics					
Age	Years	41.81	(7.44)	+	+
Sex	Male/Female	310	(81.58)	+	+
Family size	Numbers	5.97	(1.89)	+/-	+/-
Socio-economic characteristics					
Education status	Illiterate/ illiterate	288	(380)	+	+
Off-farm income	Dummy	123	(32.36)	+/-	+/-
Farming and farm specific characteristics					
Farming experience	Years	3.74	(3.07)	-	+
Farm size	Hectare	2.04	(1.12)	+	+
Livestock size	Number	3.16	(1.13)	+/-	+/-
Production of staple crops	Yes/No	110	(39.48)	+	+
Institutional characteristics					
Distance to development center	Minute	48.78	(30.37)	-	_

Variables	Measurements	Descriptive statistics		Hypotheses	
		Mean (Std)/ Freq (%)		Participation	Market supply
Use of rural credit for sesame production	Yes/No	230	(60.52)	+	+
Marketing characteristics					
Distant to near market center	Minute	58.26	(36.83)	-	-
Access to information related to price of sesame determined by ECX (Ethiopian commodity Exchange) from district agriculture office	Yes/No	153	(40.26)	-	-

Source: Own Survey (2019)

Result and Discussions

The first stage of double-hurdle model (first hurdle) Probit model has been applied to analyze the factors affecting farmers' participation decision in the production of sesame for export market via their farmer union and/or cooperative (export market orientation). A summary of the values of Probit model for the factors influencing participation decision in sesame production for export market (export market-orientation) is indicated in Table 2.

Table 2. Double-hurdle model results

Variables	1st hurdle-Probit model		2nd hurdle-truncated regression	
	Marginal effect	Std. Err.	Marginal effect	Std. Err.
Age	0.09***	0.001	0.02***	0.007
Sex	0.05***	0.041	0.16	0.147
Family size	-0.01	0.042	-0.08**	0.032
Farm size	0.01***	0.002	0.74***	0.086
Level of education	0.02***	0.005	0.09***	0.027
Livestock size	0.00	0.213	0.09	0.076
Farming experience	-0.02	0.023	0.04	0.031
Off-farm income	0.02**	0.010	-0.11	0.114
Access to information	0.42	0.294	0.04***	0.008
Staple crops	0.00	0.034	0.00	0.000
Distance to development center	-0.00	0.101	-0.00	0.001
Distance to near market	-0.01***	0.001	-0.01**	0.002
Use of credit	0.00	0.209	0.20	0.189
Log likelihood	-30.63			
LR chi^2 (13)	380.82***			

Source: Model results, 2019

*** and ****** are significant at 1% & 5% significances levels respectively.

As indicated in Table 2, the results of the model revealed that the likelihood of participation decision in the production of sesame for export market (export market orientation) was positively and significantly influenced by sex, age and level of education of the household heads and size of farm, whereas distance to the nearest market area was negatively and significantly influenced distance to near market.

Farm size (that is, land allotted for sesame crop as a whole) has a positive and significant effect on the likelihood of participation decision in the production of sesame for export market (export market orientation) at 1% level of significance level. The result showed that as the farm size of household increases by one hectare, the likelihood of participation decision to sesame production for export market increases by 1%, keeping other variables

constant. This result might be due to the fact that farmers with relatively higher farm size have more space to produce more sesame crops and hence most likely to participate in sesame export market. The results of this study confirmed the previous studies done by Alemu (2015) and Dagnaygebaw *et al*. (2018), which attested that shortage of land is one of the binding factors for the rural households' inability to produce more marketable surplus of cash crops.

Age of the household head has a positive and significant effect on the likelihood of participation decision in sesame production to export market (export market-orientation) at 1% level of significance level. The result showed that older farmers produce sesame and participate in the production of sesame to export market which might be due to the fact that they acquire adequate knowledge, benefit and experiences from participating in sesame export market. As age of the household head increases by one year, the likelihood of participation decision to sesame production to export market increases by 9%, keeping other variables constant.

Sex of the household head has a positive and significance effect on the likelihood of participation decision to sesame production to export market (export market-orientation) at 1% level of significance level. This implies that female-headed household heads were less likely to participate in the sesame export market than male-headed household heads. This result might be due to the fact that female-headed households were doomed to less access to information related to the benefit of engaging in sesame production and participation in export market and are influenced by other socio-economic and cultural factors. Hence, they participated less in sesame production to export market as compared to the male-headed households. Male-headed households had 5% higher probability of participation decision in sesame

production to export market than female headed household heads, keeping other variables constant. The finding of this study corroborates with Aysheshm's (2007) studies in Ethiopia which claimed that female-headed households are influenced by cultural influences, hence they participated less in production and marketing.

An off-farm income activity has a positive and significant effect on the likelihood of participation decision in sesame production to export market (export market-orientation) at 5% level of significance level. The result revealed that those farmers who owned off-farm income activities have higher likelihood of participation in sesame production to export market than those farmers who didn't have off-farm income activities. The result might be due to the fact that sesame production requires adequate working capital. Thus, additional income source gives a better opportunity to purchase the required inputs for the sesame production. As compared to farmers who did not have off-farm income activities, those who owned off-farm income increase the probability of participation in sesame production for export market by 2%, keeping other variables constant.

Distance of the household heads residence from the nearest market has a negative and significant effect on the likelihood of participation decision in sesame production to export market (export market-orientation) at 1% level of significance level. Distance from the nearest market to the household head residence might increase the transport costs of both input purchase and sesame export marketing. An extra minute walking time to the nearest market decreases the likelihood of participation decision in sesame production to export market by 1%, keeping other variables constant.

Educational status of the household heads has a positive and significant effect on the likelihood of participation decision to sesame production to export market (export market-orientation) at 1% level of significance level. The result implies that the likelihood of participation decision in sesame production to export market increases with educated farmers. This might be due the fact that educated household heads have better knowledge, social network, bargaining power and good managerial skill of farm enterprise choices. As compared to non-educated, being an educated household head increases the likelihood of participation decision in sesame production to export market by 2 percent, keeping other variables constant.

A summary of the values of second hurdle-truncated regression model for factors influencing sesame market supply via farmer unions and/or cooperatives to export market is also indicated in Table 2. This section focuses on factors influencing the volume of sesame export market supply via farmer unions and/or cooperatives to export market or the extent of participation in export market which was measured in quintal, farmer unions should produce sesame for export market via farmer union and/or cooperative. In the second stage of double-hurdle model, second hurdle-truncated regression model is applied and the result implies that the volume of sesame export market supply was positively and significantly influenced by age, education level of the household heads, access to market information, and size of farm, whereas distance to the development center and family size were negatively and significantly influenced.

Farm size has a positive and significant effect on the extent of participation on export market or volume of sesame export market supply at 1% statistical significance level. The positive sign suggests that farmers with relatively large farm supply produce more sesame to the export market than small farms.

This concurred with our hypothesis regarding the relationship between market supply and land holding size of farmers. On average, each additional hectare of land increases the volume of sesame export market supply by 0.74 quintal. Similarly, previous empirical studies by Alemu (2015) and Dagnaygebaw *et al*. (2018) confirmed that farm size had positively affected market supply among smallholder farmers.

Distance to near market center has a negative and significant effect on the extent of participation on export market or volume of sesame export market supply at 5% statistical significance level. The negative result implied that farmers who were far away from market centers lack price related information and incurred transportation cost, hence supplied less to the export market. A minute walking time increase in the distance of the households' residence from the nearest market center decreases the quantity of sesame supplied to export market by 0.01 quintal, keeping other variables constant.

Age of household head has a positive and significant effect on export market or volume of sesame export market supply at 1% statistical significance level. The positive result might be due to the fact that older farmers have more knowledge, resources and authority to maximize the benefit of export market potential than younger farmers. Therefore, older farmers were more likely to increase the market supply of sesame production in the study areas. A year increase in the age of household head increased market supply of sesame by 0.02 quintal.

Family size (a proxy for number of dependent family members) has a negative and significant effect on the extent of participation on export market or volume of sesame export market supply at 5% statistical significance level. The result implies that as family size increases by one family member, the

quantity of sesame supplied to market decreased by 0.08 quintal, keeping other variables constant. The negative result could be due to the fact that more family members require more food consumption for life smoothening which could be satisfied through reducing market supply of sesame production. This result is in line with the finding of Abafita *et al*. (2016) but contrary to Dagnaygebaw's *et al*. (2018) which found a positive result implying that the higher family numbers, the higher market supply of sesame.

Access to market information related to price of sesame on export market has a positive and significant effect on the extent of participation on export market or volume of sesame export market supply at 1% statistical significance level. The result implies that when the price of sesame increases, farmers are motivated to obtain advantage of better price, hence increase the volume of market supply of sesame. As compared to farmers who did not have access to market information about the price of sesame on the export market, those who had increased the volume of market supply of sesame by 0.04 quintal, keeping other variables constant. The result went along with the findings of Alemu (2015) and Dagnaygebaw *et al*. (2018).

Educational level of the household head has a positive and significant effect on the extent of participation on export market or volume of sesame export market supply at 1% statistical significance level. It is, generally, recognized that education has the capacity to equip individuals with the necessary knowledge and skills to carry out various activities with great zeal. The result showed that compared to the non-educated, educated household heads increased the volume of export market supply by 0.09 quintal, keeping other variables constant. This indicates that producers with higher level of education tend to have greater access to production and market information.

Conclusions and Recommendations

There is enormous potential to increase the production of sesame crops for international market in the study area. However, age, sex, farm size, level of education, access to information, off-farm income and distance to development center influenced the participation decision of smallholder farmers in export market-orientation and its supply. Therefore, the local and regional government should improve export market-orientation of smallholder sesame producing farmers, through facilitation of export market entry by strengthening existing farmer unions and/or cooperatives. Moreover, this could be achieved through enhancing the participation of smallholder farmers on export market via encouraging female-headed households by implementing gender mainstreaming programs, encouraging the participation of various off-farm income activities, strengthening the existing non-formal education programs, promoting wise use of land intensification methods such as the use of recommended agronomic practices and adopting other farm technologies, promoting the use of family planning programs, establishing close market information provision centers, and preparing farmers' experience sharing programs to share the rich knowledge of old farmers to the young in the district.

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