International Journal of Research Studies in Agricultural Sciences (IJRSAS)
Volume 5, Issue 7, 2019, PP 7-17
ISSN No. (Online) 2454–6224
DOI: http://dx.doi.org/10.20431/2454-6224.0507002
www.arcjournals.org

Intensity and Market Supply of Wheat Grain by Smallholder Farmers in Mao-Komo District of Benishangul-Gumuz Region, Ethiopia

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Abstract: *This study was initiated to achieve specific objective as to evaluate intensity of market supply of wheat produce in Mao-Komo district of Benishangul-Gumuz, Ethiopia. This study used cross-sectional data collected in 2014/15 cropping season from sample farm households selected through two-stage stratified random sampling techniques. Descriptive statistics and econometric models were used to analyze the data. Tobit model was applied to analyze intensity of market supply of wheat produce. The Tobit regression results revealed that educational level of household heads, land holding size, distance to main road, and lagged price of high yielding wheat produce were positively and significantly determining the intensity of market supply of wheat produce. However, sex of household head and distance from market center had negative and significant influence on intensity of market supply of high yielding wheat produce. The findings suggest that the government and stakeholders should need to focus on improving farm land productivity, strengthening the provision of education and improving infrastructures in the study area.*

Keywords: *High yielding wheat produce, Market supply, Smallholder, Tobit*

1. INTRODUCTION

Agriculture is a core driver of the Ethiopian economy which accounts for about 45 % of the Gross Domestic Product (GDP) and employs more than 85 % of the population that is directly or indirectly engaged in agriculture. It generates about 80 % of the foreign exchange earnings and provides raw materials for 70 % of the industries in the country. About 15-17 % of the Government of Ethiopia's expenditures are committed to the sector [12].

In Ethiopia, cereal production and marketing are the means of livelihood for millions of small holder households and it constitutes the single largest sub-sector in economy. Improving agricultural production provides an important option for reducing reliance on food assistance and imports of wheat grain. The use of improved agricultural technologies particularly high yielding wheat varieties is considered to be the most important input for the achievement of increased agricultural productivity and market supply of grain wheat of smallholders in Ethiopia. Wheat contribution to households' food sources (nutritional value), income, feed for livestock, hatching for roofing, and provides job opportunities for farming households and urban dwellers who are engaged in its trading activities. Moreover, wheat is one of the major cereals of choice in Ethiopia, dominating food habits and dietary practices, and is known to be a major source of energy and protein in the country [18].

The utilization of wheat has increased due to the growing of urbanization and the expansion of agro-industries used as raw material, and also considered to attain food security in Ethiopia. It is also used for making bread and traditional foods and the straw is used for animal feed and thatching of roofs [22]. Having all these importance, agriculture continues to face a number of problems and challenges such as adverse climatic conditions, limited use of improved agricultural technologies, the predominance of subsistence agriculture and absence of business oriented agricultural production system, limited access to market participation [9].

1.1. Statement of the Problem

Wheat is increasingly becoming a key staple in Africa and sub-Saharan as a result of income growth and rapid urbanization. But sub-Saharan countries and Africa as a whole produce only about 30 % and 40 % of their domestic requirements, respectively, causing a heavy dependence on imports and making the region highly vulnerable to global market and supply shocks [26]. Wheat is among the most important cereal grains in Ethiopia in terms of area coverage and production [11]. A number of high yielding wheat varieties have been introduced for the smallholder farmers of the study area.

Despite the intervention of high yielding wheat varieties widely undertaken in the district, intensity of market supply of wheat produce was not well identified. In the study area, there was no empirical information so far on the intensity of market supply of wheat produce. Therefore, this study was proposed to analyze factors that influence market supply of wheat produce, and attempts to fill the gap of information on the intensity of market supply of high yielding wheat produce. The study would addressing the question of what level of high yielding wheat grain market supply by smallholders in the study area?

1.2. Objectives of the Study

The objective of this study was to investigate intensity of market supply of high yielding wheat produce by smallholders and identify the associated factors.

2. Theoretical and Empirical Review of Market Supply

The study of market supply help filling the gap for success of commercialization. The analysis can identify factors that determine market supply. Knowing the determinants mean knowing where to focus to boost production. The point is to improve marketable surplus based on the capacity of potential market. However, how much can be increased is a question of supply determinants and demand.

Market supply refers to the amount actually taken to the markets irrespective of the need for home consumption and other requirements where as the market surplus is the residual with the producer after meeting the requirement of seed, payment in kind and consumption by peasant at source [36]. The market supply shows the quantity actually sold after accounting for losses and retention by the farmers, if any and adding the previous stock left out for sale [32]. In order to describe market supply words like marketable surplus and market surplus are usually used. Marketable surplus is the quantity of produce left out after meeting the farmer's consumption and utilization requirements for kind payments and other obligations such as gifts, donation, charity, etc.

This marketable surplus shows the quantity available for sale in the market. The market surplus shows the quantity actually sold after accounting for losses and retention by the farmers, if any and adding the previous stock left out for sale [34]. According to [19], market surplus (volume sold) in agrarian economy to constitute the basic wage good for those in the economy not controlling grain (even if they were used for its production). Market surplus is defined as the proportion of output that is market [29]. According to [7], households could differ in their market orientation depending on their resource allocation (land, labor, and capital) to the more marketable commodities, household characteristics (age, sex, and literacy of household head), access to market and roads (distance to nearest market and nearest all-weather road), access to institutional services (extension, credit and market information), village level factors (rainfall and altitude), and land fragmentation.

A clear understanding of the determinants of market supply helps to know where to focus to enhance production. There are different factors that can affect market supply. The study conducted by [21] on sesame at Metema pointed out six variables-yield, oxen number, modern input use, area, time of selling and unit cost of production-affecting sesame supply. The other study by [1] found that among the different variables that were hypothesized as determining factors for volume of market supply sex of the respondent, active labor force, total size of land owned and quantity produced were significant. [15] confirmed empirically the relationship between market supply, output and income. He obtained negative relationship between market supply and variables like family size and distance from market. The study conducted by [5] on rice marketing in Fogera wereda revealed that quantity of paddy produced, access to market information, extension contact and total livestock values had affected positively the decision to participate in rice marketing.

The study conducted by [30] on agricultural technology adoption, seed access constraints and commercialization in Ethiopia, presented comparisons between adopters and non-adopters demonstrate that the adopters groups are significantly distinguishable in terms of farmers' integration into output market (market supply). In addition, they identified that knowledge of existing varieties, perception about the attributes of improved varieties, household wealth (livestock and land) and availability of active labor force are major determinants for adoption of improved technologies and has a significant positive impact on farmers' integration into output market. Furthermore, [6] found that fruit marketable supply was affected by education level of household head, quantity of fruit produced, fruit production experience, extension contact, lagged price and distance to market. Study of [25] has identified that quantity of teff produced, access to market information, access to extension and sex of the household head were found to have positive and significant influence on marketable supply of teff. Likewise, quantity of wheat produced and access to credit were found to influence marketable supply of wheat produce positively and significantly.

The study conducted by [27] on red pepper marketing analysis in Siltie Zone by using Heckman two step models and identified that extension contact, production of pepper, non-farm income, and total livestock ownerships affect volume of pepper sale. Similarly [2], on his study indicated that marketable supply is significantly affected by access to market information and quantity of tomato produced in the case of tomato whereas access to extension service, access to market information, vegetable farming experience and quantity of potato produced in the case of potato; and district dummy, non/off-farm activities, distance to the nearest market and quantity of cabbage produced in the case of cabbage.

3. RESEARCH METHODOLOGY

3.1. Description of Study Area

Benishangul-Gumuz Regional State (BGRS) is located in the Western part of Ethiopia and stretches along the Sudanese border found around 661 Km away from Addis Ababa. The region is endowed with various resources that if properly utilized can significantly contribute to the economic development of the country. Some of the most important resources available in the region including fertile land suitable for high value crops, livestock, apiculture, fishery, minerals like gold and marble, economically important trees like bamboo and incense [31].

Mao-Komo Special district is one of the 20 districts found in Benishangul-Gumuz Regional State (BGRS), its capital, Tongo, located 112 km away from Assosa town, the capital city of the region. It is bordered by Oromia Regional State in the East, Sudan in the West, Assosa Zone in the North and Gambela Region in the South. The altitude of the district ranges from 950-1960 m.a.s.l. The temperature of the area ranges from 17.5-32 ^{o}C. The rainfall of the district is uni-modal which starts in the month of April and ends in mid-October. The annual rainfall ranges from 900-1800 mm with mean annual rainfall is 1316 mm, mostly received between May and September with the highest in July and August. The duration is about 6 to 7 months with good amount of rainfall distribution. Having an area of about 2100 Km^2 and population of about 42,050 [10]. Farming is the predominant occupation of the people in the area since it is the main economic stay of the district. Maize, sorghum, wheat, and finger millet are the dominant cereal crops produced for consumption. Coffee, sesame, nigger seed and *teff* are produced for income generation in the district. Cattle, small ruminant, donkey, poultry and honey bee are the most important livestock species found in the district. The district has potential and favorable environmental and socio-economic conditions that would suitable to wheat production.

3.2. Data Types, Sources and Methods of Data Collection

The data for this study were collected from both primary and secondary sources on a wide variety of variables. The primary data were collected through individual interviews of selected respondents and the survey was administered using semi-structured questionnaires within individual interview. To complement the primary data, secondary data were obtained from different unpublished and archival sources such as articles/literatures, official reports/memos of relevant stakeholders, CSA report data, and personal communications. Personal observation was also undertaken in order to gather information from observable factors working in high yielding wheat produce marketing. Formal and informal discussion with representatives' of households were employed.

At final overall collection of quantifiable data through quantitative survey which is essential to generate concrete and quantifiable information on selected parameters of intensity of market supply of high yielding wheat produce was identified.

3.3. Sample Size and Sampling Procedure

In order to generate a primary data, a two-stage random sampling method was employed to draw representative sample respondents. In the first stage, rural kebele administrations were selected based on their wheat growing potentials. Accordingly, three potential wheat producing kebeles were randomly selected. In the second stage, by taking the list of households from development agents' and rural kebele administrations, a total of 174 farmers were randomly sampled taking into account probability proportional to size of households in each kebele. Finally, the survey was administered and data were collected and analyzed on 174 respondents.

3.4. Methods of Data Analysis

The study of intensity of market supply of high yielding wheat produce by smallholder farmers was evaluated by statistical tools and econometric models for concluding the socio-economic, institutional, and environmental factors that impede the intensity of market supply by smallholder farmers in the study area.

3.4.1.Descriptive Statistics

Descriptive statistics were utilized to assess the socio-economic characteristics of the sample respondents for intensity of market supply of wheat grain in the study area. These information was considered to augment the econometric analysis results. The descriptive analysis tools such as minimum, maximum, mean, percentage, standard deviation, frequency distribution, t-test and chi-square were employed to assess the relationship among the variables of interest.

3.4.2.Econometric Models

In this study, the econometric analysis that was employed is Tobit model for analyzing intensity of market supply of high yielding wheat produce.

3.4.3.Intensity Of Market Supply

Concerning with the Tobit model which is an extension of probit model and it is one of the approaches dealing with the problem of censored data [20]. Some authors call such model limited dependent variable model, because of the restrictions put on the values taken by the regressand [16], and [17]. This model was utilized for analyzing the intensity of market supply of high yielding wheat produce. To investigate intensity of market supply of high yielding wheat grain (a continuous-valued choice about how much the actual quantity to sell) the Tobit model was appropriately employed.

The application of Tobit analysis is preferred to probit or logit model in such cases because it uses data at the limit as well as above the limit to estimate the regression. Hence, Tobit model was used to identify both factors and intensity of market supply influencing actual supply of high yielding wheat grain. Thus, maximum likelihood Tobit estimation [35] was used for the analysis of sales volume of high yielding wheat grain. According to [23], the Tobit model could be specified as follows;

$$Y_i = Y_i^* = X_i\beta + \mu_i \quad \text{if } Y_i^* > 0 \qquad (1)$$
$$Y_i = 0 \quad \text{if } Y_i^* \leq 0$$

Where Y_i = the observed dependent variable

Y_i^* = latent variable (which is not observable)

X_i = vector of explanatory variable

β = vector of parameters to be estimated

μ_i = an independent normally distributed error term with zero mean and constant variance.

Note that the threshold value in the above model is zero .This is not very restrictive assumption, because the threshold value can be set to zero or assumed any known or unknown value [4]. The

model parameter is estimated by Maximizing the Tobit Likelihood Function of the following from [23].

$$L = \prod_{Y_i^*>0} \frac{1}{\sigma} f\left(\frac{Y_i-\beta_i X_i}{\sigma}\right) \prod_{Y_i^*\leq 0} F\left(\frac{-\beta_i X_i}{\sigma}\right) \quad (2)$$

Where f and F are the density function and cumulative function ofY_i^*, respectively. In this case, $\prod_{Yi*>0}$ denotes the product over I, for which $Y_i^* > 0$, and $\prod_{Yi*\leq 0}$ denotes the product I for which $Y_i^* \leq 0$.

To predict the effect of change of explanatory variables, one has to compute the derivation of estimated Tobit model. An alternative technique is proposed by [20] as to how to decompose the effects of explanatory variables into market supply and intensity effects. Thus, a change in Xi (explanatory variables) has two effects. It affects the conditional mean of Y* in the positive part of the distribution, and the probability that the observation will fall in that part of the distribution.

The marginal effect of an explanatory variable on the expected value (mean proportion) of the dependent variable:

$$\frac{\partial E(Y_i)}{\partial X_i} = F(z)\beta_i \quad (3)$$

Where $\frac{\beta_i X_i}{\sigma}$ is denoted by z,

Similarly, the change in intensity of quantity supplied with respect to change in explanatory variable among sellers would be estimated by:

$$\frac{\partial E(\frac{Y}{Y_i}>0}{\partial X_i} = \beta[1 - Z\frac{f(z)}{F(z)} - (\frac{f(z)^2}{F(z)})J \quad (4)$$

F (z) = is the cumulative normal distribution of z

f (z) = is the value of the derivative of the normal curve at a given point (unit normal density)

z = is the z score for the area under normal curve

ß = is the vector of Tobit Maximum Likelihood estimates and σis the standard error of the error term.

3.5. Definition and Measurement of Variables

The hypothesized variables expected to influence intensity of market supply of high yielding wheat produce in the study area were explained in the following manner:

3.5.1.Dependent Variable

Quantity supplied: It refers a continuous variable (natural log of quantity supplied) which represents dependent variable and measured in quintals; the actual supply of wheat produce by farm households to the market.

3.5.2.Explanatory Variables

Different theoretical and empirical studies conducted elsewhere on factors influencing intensity of market supply particularly high yielding wheat produce indicate the role of institutional, socio-economic and bio-physical factors in determining farmer's market supply decision. The model assumes that the dependent variables that is intensity of market supply of wheat produce depends on the education of the household head in years of schooling, sex of the household head, involvement of the household in off-farm activities, farming experience of the household head in years, family size of households, total farm size in hectare, livestock unit owned by farmers, frequency of extension contact, distance from market center, distance to main road, access to credit, lagged price of wheat produce, farmers' membership to village organization, etc. The variables utilized in the study and their theoretical expectations about the sign and magnitude of these variables on the intensity of market supply of wheat produce were displayed below.

Table1. *Summary of the independent variables affecting intensity of market supply*

Variables	Measurements	Expected effect on market supply
Sex of household head	Dummy; 1=Male, 0=Female	+ve
Family size	Continuous, total no. of family members	+ve
Educational level	Continuous, years of schooling	+ve
Farming experience	Continuous, years of farming	+ve
Land holding of household	Continuous, hectares	+ve
Livestock holding unit (tlu)	Continuous, values	+ve
Distance from market center	Continuous, kilometers	-ve
Access to credit	Dummy; yes/not	+ve
Distance to main road	Continuous; Kilometers	+ve
Frequency of extension contact	Continuous; no. of days	+ve
Non-farm income	Continuous (log); ETB	+ve
Lagged price of wheat (log)	Continuous, ETB	+ve
Farmer's affiliation to organizations	Dummy; yes/not	+ve

4. RESULTS AND DISCUSSION

The study presents the descriptive results explaining intensity of market supply of wheat grain by smallholder farmers through the statistical analysis of descriptive tools and empirical results of econometric analysis.

4.1. Descriptive Analysis

Descriptive statistics such as mean, minimum and maximum values, range and standard deviations were used to describe the socio-economic and institutional characteristics of the households under considered in the study of high yielding wheat varieties adoption. Table 2 below, depicts the statistical description of sample households.

Table2. *Summary of households' characteristics*

Description	N	Min	Max	Mean	Std.Dev
Distance from market center	174	0.7	9	4.29	2.49
Distance to main road	174	0.01	9	2.8	2.57
Experience of farming	174	0	57	24.44	10.82
Educational level of household head	174	0	10	1.74	2.16
Family size of households	174	2	17	7.16	2.74
Farm land holding of households	174	0.125	5.13	1.44	0.92
Tropical livestock unit	174	0	41	8.21	8.13
Frequency of extension contacts	174	0	120	16.72	15.61

Source: *Own survey, 2015*

The sampled households on average walk 4.29 kilometer of distance to access nearest market center while the average distance to get main road is about 2.8 km in the study area. The study indicated that the average size of land held by the households is 1.44 hectares with standard deviation of 0.92.The maximum is 5.125 hectares while the minimum is 0.125 hectare. The average family size of the sample households is about 7.16 with maximum of 17 persons and minimum of 2 person's for the study area. The average experience of the respondents was 24.44 years (Table 2).

4.2. Econometric Estimation Results

4.2.1. Intensity of Market Supply

Tobit model was used to identify factors affecting intensity of market supply of high yielding wheat produce and the decision of households marketing. The data have a censored sample as dependent variable since about 17.27 % of total sample households, and 34.48 % of adopters household didn't supply high yielding wheat produce for markets even if they produce high yielding wheat grain. If zero values of dependent variable was the result of rational choice of farmers, Tobit model was found to be more appropriate. Thus, maximum likelihood Tobit estimation [35] was used in the analysis of

factors affecting sales volume. One can concern with the model; recall that in a Tobit with left-censoring at zero.

The Tobit model estimated the results of the variables that are expected to affect intensity of market supply of high yielding wheat produce. Attempts were made to include all theoretically important factors in the Tobit model for intensity of market supply and its factors that expected to influence high yielding wheat produce market supply in the study area. The variables which have significant relationship with the decision of marketing and intensity of market supply of high yielding wheat produce were sex of households head, level of education, size of farm land holding, distance from market center, distance to main road, and lagged price of high yielding wheat produce.

Table3. *Intensity of market supply of high yielding wheat produce*

			Number of observation =174	
			F (12, 162) = 8.23	
			Prob > chi^2 = 0.0000	
			Pseudo R^2 = 0.3530	
Log pseudo likelihood = -89.33				
Quantity of HYWV Sold (log)	**Coefficient**	**Robust Std. Err**	**Change among sellers**	**Change among whole**
Sex of households	-0.725**	0.346	-0.126	-0.136
Educational level	0.099*	0.054	0.014	0.116
Distance to market center	-0.131*	0.076	-0.019	-0.015
Distance to main road	0.189**	0.073	0.027	0.022
Family size	0.049	0.044	0.007	0.006
Land holding size	0.453***	0.166	0.065	0.053
Tropical livestock unit	0.019	0.048	0.003	0.002
Frequency of extension contacts	0.003	0.008	0.001	0.001
Access to information	0.407	0.397	0.055	0.041
Perception of households	-0.272	0.579	-0.042	-0.038
Lagged price (log)	0.414***	0.058	0.059	0.048
Affiliation to organizations	-0.866	0.576	-0.157	-0.176
Constant	-2.889***	0.983		
Sigma	0.992	0.099		
Left censored observation			132	
Uncensored observation			42	

*Note: *, **, and *** indicates significant at 10 %, 5 % and 1% significance levels, respectively*.

Source: *Own survey, 2015*

Having different educational level of the household head and distance from market centers determine the intensity of market supply of high yielding wheat produce positively and negatively at 10 % significance level, respectively. Whereas sex of households head, and distance to main road have negative and positive significantly influence on intensity of market supply of high yielding wheat grain at 5 % significance level, respectively. However, land holding size of households and lagged price (measured in ETB and transformed into natural log) of high yielding wheat produce have strongly and positively significant influence on the households decision to marketing and intensity of market supply of high yielding wheat produce at 1 % significance level.

The result of the Tobit model analysis indicated that sex of household head significantly and negatively related with intensity of market supply of high yielding wheat produce in the study area. It was realized that being female-headed households negatively influences intensity of market supply of wheat produce as compared to male-headed households. This indicates that female-headed households market supply of high yielding wheat produce less as compared to their counterparts. The possible explanation for this is that female farmers have less access resources (land and labor endowments) and information with their counterparts that reduce the intensity of market supply to market. The result implies that male-headed households most likely prefers selling wheat produce instead of letting grain marketing for female. This means that females are less likely to participate in the process of selling wheat produce and price and other transactional bargaining. The marginal effect result showed that for being female-headed households, the intensity of market supply of high yielding wheat

produce decreases by 13.6 % among the whole sample households and 12.6 % among sellers' groups. The finding is consistent with the result of [28]

Educational level of household heads found positively and significantly influence intensity of market supply of wheat produce (the actual quantity of high yielding wheat produce market supply) to available nearest markets. The result of the Tobit model indicates that intensity of market supply of high yielding wheat produce to market increases as the level of educational grade attended by the households' increases. The plausible reason could be higher educational level enrich the capacity of an individual to upgrade and synchronize the quantity of high yielding wheat grain supply with appropriate place and time of market demand so that the total sale market supply increased. Moreover, the marginal effect result showed that each additional higher grade attended by the respondent led to increase the intensity of market supply of high yielding wheat varieties by 1.4 % of sellers groups and 11.6 % among the whole sample groups. This is because being educated, farmers become more knowledgeable about the prevailing market situations and so are able to make informed marketing decisions such as where to market and prices. Similar results were reported by [33] and [3] found highly educated farmers to be more market supply of their produce.

The distances from the market center influence households in buying inputs and selling outputs particularly determine high yielding wheat grain marketing decision and intensity of market supply of farmers negatively and significantly in the study area (Table 3). Distance from market center negatively affected the intensity of market supply of high yielding wheat produce sold; this maybe because of the increased transaction costs associated with marketing of the farmers' produce. The closer the market place to households' residence, the lesser would be the transportation costs, transaction costs, time, and more access to market information. This is because the nearer to market, the easier it is to access buyers who offer better payment than the case of farmers far away from market center. Therefore, as the farmers' located one kilometer away from the market center, the intensity of market supply decreases by 1.5 % among the whole sample households and 1.9 % of the sellers group. This implies that the location of farmers in respect of markets center is an important factor in encouraging farmers to increase their quantity of market supply. The study result is consistent with the finding of [7], [13], [6], [2], [8], [37] and [14] showed that distance from the market center affected market supply negatively.

Distance to main road affects intensity of market supply positively and significantly, suggesting farmers who have nearest distance to main roads are more likely to market supply high yielding wheat produce that is essential for timely market supply of output. This implies accesses to means of transportation affect positively intensity of market supply of high yielding wheat produce. A unit decreases (one kilometer) in distance from home to main road, increases the intensity of market supply by 2.7 % among sellers and 2.2 % among the whole sample. This implies that farmers near the main road supply and sold more than farmers away from the main road. Farmers near the road can get transportation facility easily and they can transport the high yielding wheat produce at lower cost than the farmers far away. The result is similar with the finding of [38] supply analysis in wheat industry.

Farm land holding size was strongly and significantly affected market supply positively. This is in agreements with earlier hypothesis that farmers who own large size of farmland are more likely to produce more high yielding wheat output and induce the quantity of market supply. It is also notable to observe that the intensity of market supply increases as land holding size increases among the farmers that adopting high yielding wheat varieties. As size of land holding increased by one hectare, intensity of market supply increased by 6.5 % among the sellers groups and by 5.3 % of the whole sample. The results suggests that those who have large farm size among the adopter farmers devote more of their farmland to the cultivation of high yielding wheat varieties and more increase the market supply of wheat grain. This presumed that farmer who has more cultivated land size have a positive influence on market supply, because if a farmer owns more land, the probability of allocating more land size for high yielding wheat varieties would increase. This reflects that the tendency of farmers to give more farm land size for the production and in turn marketing of high yielding wheat produce that are considered to be of better price value for the farmers. This result is in agreement with the findings of [8], [3] and [14].

Lagged price (which was measured in ETB and transformed into natural logarithm) of high yielding wheat produce have positive and significant influence on the intensity of market supply of the high

yielding wheat grain. This is because many farmers sensitive to market prices for their produce and they supply in response to market signal; because it means getting higher incomes from their produce. Farmers tend to study price situation related to high yielding wheat produce and could appropriately predict and respond to the prices by producing more quantity of output that affected market supply of the grain. The study by [6] showed that price had positive and highly significant effect on the volume crops supplied to market. The marginal effects indicates in favor of intensity of market supply of high yielding wheat produce, other factors kept constant, an increases by 1 % in lagged price increases the intensity of market supply by 5.9 % among sellers groups and 4.8 % among the whole sample.

5. Conclusion and Policy Implications

5.1. Summary and Conclusion

The Tobit regression results showed that intensity of market supply of high yielding wheat produce by smallholder farmers influenced by sex of households head, educational levels of households, land holding size, distance from market center, distance to main road, and lagged price of high yielding wheat produce in the study area. Moreover, educational level, distance to main road, lagged price, and land holding size were determinant factor which is found to be positively and significantly affecting intensity of market supply of wheat produce. While sex of households head and distance from market center were negatively and significantly associated with intensity of market supply of wheat produce in the study area. The implication of this negative correlation is that as the distance of farmers' residence far away from market center, the farmers would be discouraged for market supply wheat grain.

5.2. Policy Implications

Based on the above findings, the following recommendations were generalized to enhance intensity of market supply so as to improve farmers' income from farm activities.

Farmers with more land are more likely to allocate a relatively higher share of their land for high yielding wheat grain and supplied more to market. However, increasing the size of landholding cannot be an option to increase high yielding wheat produce and then market supply since land is a finite resource. Therefore, intervention aimed to improve land fertility status and increasing productivity of land through proper utilization of available land resource is required.

Educational level of the households also played significant role in the intensity of market supply of high yielding wheat produce. Market supply of wheat produce could be facilitated through educated farmers to be used as model farmers since they follow production of high yielding wheat produce stick to the market situation in their area. A relevant stakeholder has to find ways by which farmers' formal and informal adult education at their localities would be enthused in relation to their production packages and new techniques of farming, production management practices and market aspects that enable them to analysis the market situations. Promotion of adult education among the farming community and creating experience sharing event to imitation best practice is recommended.

Distance to main road has become important determinants of farmers in the intensity of market supply, suggests the role of policies geared towards improving existing all-weather rural road and constructing new road connecting villages farming communities with market centers. Hence, further strengthening development of the road infrastructure in the rural areas to increase farmer's access to transportation facility and decrease transaction cost to get better access to improved agricultural technologies is required. In general, attention should be given to development of infrastructure, especially establishment of road facilities around the production centers and transportation availability that lower rate of transaction costs for enabling farmers to provide more produce of better quality for market supply.

Acknowledgement

My heartfelt gratitude is owed to my advisor, Dr. Degye Goshu for his fruitful and constructive suggestions and assistance throughout the development of this paper. I would like to express my sincere thanks to Global Development Network for partially sponsoring my research study.

I would like to thank my employer, Ethiopian Institute of Agricultural Research (EIAR) for providing me the study and financial and logistic support through Assosa Agricultural Research center. At last,

but not least, my special gratitude goes to my whole family for their valuable support during preparation of the paper.

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Citation: *Regasa Dibaba, Degye Goshu, "Intensity and Market Supply of Wheat Grain by Smallholder Farmers in Mao-Komo District of Benishangul-Gumuz Region, Ethiopia" International Journal of Research Studies in Agricultural Sciences (IJRSAS), 2019; 5(7), pp. 7-17, http://dx.doi.org/10.20431/2454-6224.0507002*