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Decision on Market Participation of Rice Producers in Fogera District, Northwest Ethiopia

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Abstract: The recent studies indicated; determinants of rice market participation need further investigation in Fogera district. Therefore, this study was conducted to identify determinants of rice market participation decision and the quantity of rice marketed by rice producers. To address these objectives, both primary and secondary data were collected in 2018/2019 farming season. Both descriptive statistics and double hurdle econometric model were used to analyse the data of 212 sample rice producers. From the sample rice producers, 78.3% were market participants and the remaining 21.7% were non participants. The results of the study indicated, market distance was significantly and negatively influencing the probability of rice market participation, while credit use, production and market information were significantly and positively influencing the probability of rice market participation. Whereas, education level, credit use, production, labor and rice land size were significantly and positively influencing the quantity of rice marketed supply. The finding of this study emphasis the importance of socio economic, institutional and market factors related to yield enhancing rice technologies, use of credit and having access to market information. Therefore, development interventions could focus on improving such socio economic, institutional and market determinants to make farmers' rice market participation wider.

Keywords: Double Hurdle, Fogera, Market Participation, Rice

1. Introduction

Rice has been in use for more than 10,000 years and longer than any other crops [1]. The largest producers of rice are China, India and Indonesia with a produce of 211405211, 177645000 and 54604033 tons in 2019, respectively. Ethiopia takes almost zero share in the world with the produce of 170630 tons in 2019 [2].

Under the current situation of the rice sector in Ethiopia, the research and development gaps have been identified in different producing regions of the country. Accordingly, the estimated potential area of rice production in Ethiopia is about 30 million hectares. However, area allocated for rice in 2006 and 2013 is 6 and 58 thousand hectares, respectively. Fogera district takes the lion's share in rice production that contributes 58% of the region and 28% of the national production. Over time, the quantity of rice marketed at the market is increasing due to the rising prices and growing demand [3]. For example, the proportion of produced rice sold has increased from about 75 percent to 98 percent [4] and [5]. Moreover, there is compatibility of rice with the local farming system in Fogera plain and other rice producing areas. To mention, it is used as flour in the making of traditional foods which includes *injera*, local drinks (*tela* and *areki*) and bread. The residuals of rice like straw and the husk are also being used as animal feed. This also signifies the compatibility of rice to the crop- livestock farming system. The above utilization of rice in different forms has led to an increasing pattern of rice consumption. With this regards the current rice production is unable to meet the increasing level of demand.

The increase in demand has led to the imports of rice each year starting from 1993. Based on ERCA data (2010 and 2016), imports of rice have increased from 43,247.69 tons in 2010 with a value of about US$25.76 million to 311,827.08 tons in 2016 with a value of US$170.69 million. This has led to the emergence of different value chain actors involved in

rice production, processing and marketing. Accordingly, a number of initiatives have been implemented through the government extension program and development partners which includes MEDA (Mennonite Economic Development Associates) and Agro BIG (the Agro-Business-Induced Economic Growth Program) to ensure availability and access to quality seed based on farmers preference [3]. The issue of inability to meet the domestic demand can be associated with rice production and marketing constraints which includes lack of knowledge on grading, lack of market information, price seasonality, limited number of buyers, poor quality of agricultural products and weak market extension service purpose [6].

There was a study done by [5] on the determinants of rice supply to the market. But, it is long time that there might be existed dynamism on rice market participation. Additionally, there was a study done by [7] on the determinants of Rice Production and Marketing in Low Producer Farmers in Fogera district. However, this study have emphasized on the determinants of rice production, the structure of rice marketing and channels of rice marketing. This means that market participation decision by rice producer farmers has not been studied systematically. The report by [3] indicated that the determinants of rice market participation and the levels of rice sold by different types of farmer needs future investigation. This investigation has recommended from the context that rice production is expanding in Ethiopia in general and in the study area in particular. Therefore, this study attempts to fill the knowledge gap on the determinants of market participation by rice producers in Fogera district. Therefore, to fill the gaps identified in the above problem statements, the current study on "decision on market participation of rice producers: a case of Fogera district" was conducted.

2. Methodology

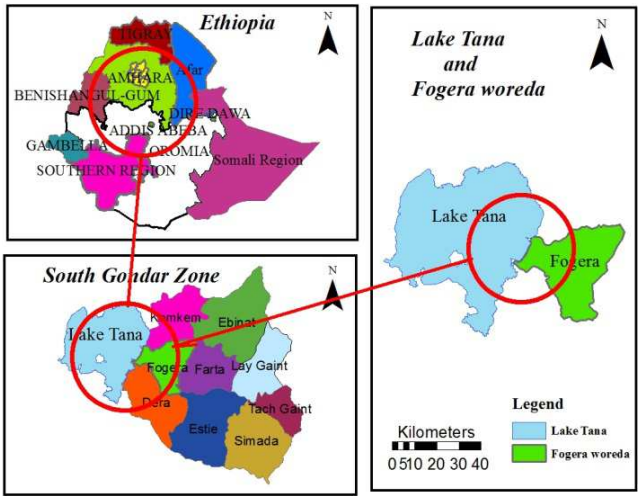
2.1. Study Area

Fogera district is located in South Gondar Zone of the Amhara National, Regional State in northwestern Ethiopia. It is located in North-West of Bahir Dar town at 625 Km from Addis Ababa, 55 Km from the Regional capital, Bahir Dar and 42 km from the capital city of South Gonder, zone, Debre Tabor, on the main highway leading to Gondar. The district is bounded by the Farta district in the East, Dera district in the South, Lake Tana in the West and Libokemkem district in the North [8]. Fogera is situated 11°46 to 11°59 latitude North and 37°30 to 37°52 longitude East. Altitude ranges from 1774 to 2410 meters above sea level with mean annual rainfall of 1216 mm and mean annual temperature of 19°C.

Farmers depend on the long rainy season for crop production and crop -livestock mixed farming system is a common practice in the area. Rib and Gumara are the two major rivers that cross many of rice producing kebeles and flooding the plain. These two rivers have economic importance to the areas as they are used for irrigation purpose for vegetable production during the dry season.

The total human population of the district is 253,790. The rural population is estimated at 245,830 [9]. Agro-ecologically the district is characterized as majorly mid and high land. Topographically, the flat area accounts for 76%, mountain and hills 11% and the valley bottom area 13%. The total area of the district is 117, 414 hectares. The land use pattern of the district is characterized by 59.03% cultivated land, 22.73% grazing land, 18.24% water bodies and the rest for others [8].

The major crops in the study area are rice, maize, finger millet, tef and barely [8]. The basic information with respect to these major crops is described.



Source: Ethio Geospatial data

Figure 1. *Location map of the study area.*

2.2. Sampling Procedures and Sample Size Determination

The samples for this study were drawn from rice producers in Fogera district. A three stage sampling technique was employed to select sample households. Fogera district has a total of 33 rural kebeles. From these, 16 kebeles were identified as potential in rice production for selecting sample kebeles. Using the simple random sampling technique, three Kebeles were selected. This is because the study has done on one district, particularly only rice producers, which is an indication that homogeneity of the population can be increased. Then, systematic random sampling technique was employed to select sample rice producers. The main reasons for using a systematic random sampling technique were the homogenous nature of the population in terms of socio-economic characteristics, institutional set up and means of livelihood. The other reason is the availability of sampling frame (List of the household heads) at each kebele.

There are different strategies for determining the sample size. These include a census, the level of precision, degree of variability, using a sample size of a similar study, using published tables and using formulas [10]. These strategies are not rigid in determining the sample size. Once the minimum sample size is determined, additional samples might be used to increase the representativeness of the sample. For this

study, the sample size was determined using Yamane formula [11]. This is because the population size is known and the precision level is considered.

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

Where: n= Sample size, N= population size (rice producer farmers in the production year 2018/2019) which is 3554 and e is the precision level which was 0.07 in this study due to the fact that the population in the study area is relatively homogeneous in the socio economic set up. In determining the sample size, the formulas are used to determine the minimum sample size and it is valid for 95% confidence level. Based on the above formula, 193 sample respondents were selected using systematic random sampling technique. Hence, to make the sample size more representative, additional 19 respondents were added to 193. As a result, cross sectional data were collected from the 212 sampled households. The sample size for each kebele was determined based on their proportion to the total households in each kebele.

Table 1. *Distribution of sample respondents among selected kebeles.*

Kebeles	No. rice produers	No. samples selected	Proportion
Shaga	1800	107	50.5%
Tiwa Zakena	1200	72	33.9%
Addis betekrstian	554	33	15.6%
Total	3554	212	100%

Source: own computation [8].

2.3. Methods of Data Analysis

Both descriptive and econometric analysis methods of data analysis were used. Data analysis was executed using STATA software-version 14.2.

2.3.1. Descriptive Analysis

Descriptive statistics such as mean, percentage, frequency and standard deviation were used. Additionally, descriptive tool such as tables were employed to present data. Other econometric tests like VIF (to detect multicollinearity problem), Omitted variable test (to detect misspecification problem) and heteroscedasticity (to test for constant variance of each error term from each individual data), which are econometric assumption of the Classical Linear Regression Model, were executed. The value of Variance Inflation Factor (VIF) and Contingency Coefficients were computed using their corresponding formulas. The Contingency Coefficient was used to test the correlation between categorical variables. To mention, the correlation between sex of the household head and cooperative membership was tested through Contingency Coefficient. Whereas VIF was used to detect multicollinearity problem among the continuous independent variables.

$$\text{VIF (Xi)} = \frac{1}{1-R^2}$$

Where, R^2 stands for square multiple correlation coefficients between Xi and other explanatory variable. Practically, there is no any variable which is not correlated with other explanatory variables. If the VIF values exceed 10, the problem is serious which results in the inflated standard errors [12].

$$\text{CC} = \sqrt{\frac{\chi^2}{n+\chi^2}}$$

Where, χ^2 stands for chi-square and n stands for sample size. The correlation is serious problem, if CC value exceeds 0.75 [12].

2.3.2. Model Specification for Econometric Analysis

Empirical studies on analysis of the smallholder market participation have used various analytical models depending upon their nature of the dataset. These analytical models include, Ordinary Least Squares (OLS), Tobit model, Heckman two stage model, and double hurdle model. The selection of the model depends upon the nature of the study and underlying assumptions of the models. If all farmers are market participants, the preferred model to be used is Ordinary Least Squares (OLS). In the study area the market participation is conditional. Hence, there are market participant and non-participant of rice producers. Now, the optional models are reduced to Tobit, Heckman two stages and double hurdle. Model specification tests made between Tobit and double hurdle, and double hurdle and Heckman two stages. In the testing process, Tobit and Heckman two stage models were rejected (Table 3). Hence, independent double hurdle model was used for this study to execute econometric analysis. Because it has tested that there is no correlation between error terms of the two separate decisions. Hence, it was proved that there is no selection bias and there are two decisions which are discrete decision of whether or not to participate in the market and a continuous decision of rice sold by the rice producer farmers. Moreover, the variables affecting the two decisions may not be the same. The independent double hurdle model is characterized by flexibility of the independent variables to be used for the two separate decisions. In independent double hurdle model, the two decisions were estimated using Craggit model. The procedure is as follows:

The First decision of hurdle:

$$D_i = 1, \text{ if } D_i^* > 0 \quad (1)$$

$$D_i = 0, \text{ if } D_i^* <= 0 \quad (2)$$

$$D_i^* = \beta_i X_i + U_i, \quad (3)$$

Where $D_i^* = 1$ for market participation and 0 otherwise.

U_i is the error term and normally distributed with (0, 1).

β_i= A vector of Parameters to be estimated.

X_i= the vector of explanatory variables included in the first hurdle.

The second decision of hurdle:

$$Yi = A_i Z_i + V_i, \quad (4)$$

Where *Yi* = the amount of rice sold to the market.

V_i= the error term and normally distributed with (0, σ^2).

A_i = A vector of parameters to be estimated.

Z_i = the vector of explanatory variables included in the second hurdle.

The log-likelihood function for the double hurdle model is:

$$\log L=\ln[1-\Phi(\alpha Z_i(\beta X_i\sigma))]+\ln[\Phi(\alpha Z_i*)1\sigma\Phi(Y_i-\beta X_i\sigma)] \quad (5)$$

Since the model used is independent double hurdle, there is the assumption of independence between the two error terms (Ui and Vi). In this case, the double hurdle model is equivalent to a combination of probit model (decision one) and the truncated regression model (decision two) [13]. The estimation can be done jointly or step by step as the resulting output is the same in both cases. For this study, the joint estimation was executed using the Craggit command [12]. Hence, the probability of market participation and the level of participation were estimated using a single command.

Table 2. *Operational definitions of explanatory variables.*

Variables	Operational definitions	Measurement	Type	Ex. Sign
Age	Age of the household head	Completed years	C	±
Educational level	Households' education level	Completed years	C	+
Sex	Whether the household is male or female	1=male and 0=female	D	±
Annual income	Gross annual income	ETB (000'Birr)	C	+
Household size	No. of household members	Number	C	±
Rice land size	Cultivated rice land size	Hectares	C	+
Number of livestock	Total livestock owned by the household	TLU	C	+
Quantity of rice produced	The amount of rice produced by the household	Quintals	C	+
Distance from market	Distance from the nearest market	Kilometers	C	-
Access to market information	Whether the household has access to market information or not	Having access =1 and 0 otherwise	D	+
Rice farming experience	Household's rice farming experience	Completed years	C	+
Agricultural extension of rice	Whether the household gets extension service on rice or not	Getting extension service=1 and otherwise =0	D	+
Distance from road	Distance from the nearest road	In kilometers	C	-
Credit use	Whether the household use credit or not	Credit use=1, 0 otherwise	D	+
Cooperative membership	Whether the household is a member of the cooperative or not	Member=1 otherwise=0	D	+
Labor	Active family labor of the household	Man-day equivalent	C	+
Oxen number	Total oxen owned by the household	Number	C	+

C= continuous and D = dummy variables.

2.4. Model Specification Test

The double hurdle model was tested against the Tobit model and the later rejected. This is because the model specification result revealed that the calculated statistical value of likelihood ratio for rice market participation is 42.58 which is greater than the tabulated or critical value of chi square at df (14) =23.68 at 5% level of significance. This is the strong evidence that there are two separate decisions in which households make independent decisions of the market participation and the level of selling. Additionally, it was tested for selection bias of the two error terms of the two separate decisions. The likelihood ratio result of heckman two stage selection is insignificant (Prob > chi2 = 0.2628). This indicates that there is no selection bias in the sample. No selection bias in the sample means the error terms of the two separate decisions in market participation are not correlated. So, Cragg's independent double hurdle model is appropriate for this study (Table 3).

STATA version 14.2 was used to do analysis on the determinant of both the rice market participation decision and the level of market participation. For analysis, the first and second hurdles of the model were executed simultaneously. In using this model, basic commands have employed for analysis. Since multicollinearity is a common problem in any regression analysis, diagnostic test was conducted through Variance Inflation Factor (VIF) to identify any potential model misspecification problems. VIF was used to test the correlation among continuous independent variables; however, Correlation Coefficient (CC) was used to test the correlation among categorical independent variables [13]. Since the model used was independent double hurdle, the VIF was executed for the two models independently. The test indicated that the mean VIF values are 1.107 and 1.142 for the first and second hurdles, respectively. The VIF value 10 is a cut point to decide on the presence of multicollinearity. Because the VIF values were below the cut point, multicollinearity was not a serious problem in the estimated models. Pairwise correlation was also done for categorical independent variables for the two independent models, and it was found that there is no high (but not perfect) correlation between the variables for two hurdles. On the other hand, heteroscedasticity was detected through Breusch-Pagan / Cook-Weisberg test and the test value was Prob > chi2 = 0.0070. Since this probability value is significant, heteroscedasticity was identified as a common problem in this cross-sectional data. Procedurally, it was corrected through estimating the models using robust standard errors. Moreover, the model was tested for its omitted variables using a Ramsey RESET test which indicated that no evidence of functional form misspecification in the model.

Table 3. *Model Specification Test.*

Model	hypotheses	Calculated value	Tabulated value	Decision
Independent double hurdle Vs. Tobit	Ho: Tobit model is appropriate H1: double hurdle is appropriate	Tobit test = 42.58	Df = 14, SL = 5% $X^2 = 23.68$	Reject Tobit model
Independent Double hurdle Vs. Heckman	H0: There is no selection bias H1: There is selection bias	[Mills]Lambda = 0): chi2(1) = (1.25, 14) Prob > chi2 = 0.2628		Reject heckman model

Source: own data, 2020.

3. Results and Discussion

3.1. Rice Production and Market Participation

The mean and frequency were used to summarize continuous and dummy variables, respectively. The descriptive statistics result reveals the distribution of rice producing households about their position in rice market. About 78.3% of sample households were market participant, while the remaining 21.7% were non participant. The reasons for non-participating in the market may include; non-participants may fulfill their cash need requirements through selling onion, onion seed and some farmers may loss parts of their produce due to occurrence of flooding on their parcels. This result is higher than [4] finding which stated that 75.8% of rice producers have been participated in rice selling. On the other hand, this result is lower than [5] finding which stated that 98.8% of rice producers have been participated in rice selling. This might be due to the increasing pattern of rice consumption in different forms in the study area. On average, the amount of rice produced per sample household was estimated 30.92 quintals, while the volume of rice sold per sample household was estimated 9.56 quintals. This implies that, majority of the rice produced was used for consumption and seed purpose in the study area (Table 4).

Table 4. *Description of rice production and market participation.*

Variables	Obs.	Mean/Frequency	St. dev./Percent
Production	212	30.92	12.97
Market participation decision(Yes)	212	166	78.3
Volume of sell	212	9.56	7.96

Source: own data, 2020.

3.2. Determinants of Rice Market Participation Decision (1st Stage of Double Hurdle Model)

The results for the determinants of rice market participation have a binary nature and estimated using the probit model (the first hurdle or tier one) is shown in Table 5. The Wald chi-square value of 66.33 is statistically significant at 1% indicating that the explanatory variables in the model jointly explain both the probability of market participation and level of market participation. From the estimation results, coefficients in the first hurdle indicate how a given variable affects the likelihood (probability) of rice market participation. Accordingly, the first hurdle (tier 1) results were interpreted through marginal effect. On the other hand, the coefficients in the second hurdle indicate how variables influence the quantity of rice marketed supply. In the estimation process, 28 explanatory variables were included in the two hurdles. Out of 14 explanatory variables; four variables determined the decision to sell rice. Hence, the result of the first hurdle (Probit Model) indicates that, distance from the nearest market, credit use, production and market information are the significant determinants of rice market participation decision. The significant variables determining the decision to participate in rice market are distributed over the three categories of the covariates: institutional (credit use), market (distance from the nearest market and access to market information) and economic (production) (Table 5).

Distance from the nearest market was included as an explanatory variable in the model. It was expected to negatively affect the likelihood of rice market participation decision. The coefficient of distance from the nearest market is statistically significant at 5% and has a negative effect on the probability of rice market participation decision. Accordingly, its marginal effect implies that an increase in market distance by one kilometer decreases the likelihood of participating in rice market by 1.1%. This implies that farmers farther away from market place have small farm size for rice and they consume more than those near to the market. This result is consistent with the findings of [14, 15].

The expected influence of credit use on the likelihood of rice market participation was positive. The coefficient of credit use is statistically significant at 10% and has a positive effect on the likelihood (probability) of rice market participation. Moreover, the marginal effect of credit use indicates use of credit increases the probability of participating in rice market by 12%. The implication might be seen from two angles. Since rice is labor demanding, the credit may be used for covering the cost of labor. In addition to credit directly used for rice cultivation, credit taken for livestock fattening purpose has also indirect contribution for rice cultivation from the income obtained from selling of fattened oxen. This result is consistent with the finding of [16].

Quantity of rice produced was expected to influence the probability of rice market participation positively. In this study, the coefficient of quantity of rice produced is statistically significant at 5% and has a positive influence on the probability of rice market participation. Hence, the marginal effect of production of rice implies that an increase in quantity of rice produced by one quintal increases the probability of rice market participation by 0.5%. This is in

line with the general theory that high amount of production can encourage farmers to participate in the market. This result is consistent with the findings of [4, 17, 18].

Having access to market information was expected to have a positive influence on the likelihood of rice market participation. Accordingly, the coefficient of market information is statistically significant at 1% and has a positive effect on the probability of rice market participation. Besides, the marginal effect of access to market information indicates that having access to market information on rice increases the probability of rice market participation by 27.5%. The implication might be related with addressing price information of rice (price of all districts and towns in Amhara region) each week. On the other hand, the existence of rice seed producer cooperatives and processors in the district might create an opportunity of accessing price and buyer information for rice producers. This result is consistent with the findings of [19, 17, 15].

Table 5. *Estimates of double hurdle model for market participation decision.*

First hurdle(Tier 1)			
Variables	**Coeff**	**Robust St. Error**	**Marginal Effect**
Sex	-0.151	0.303	-0.030
Age	-0.037	0.032	-0.008
Education	0.014	0.044	0.003
HH size	0.086	0.060	0.018
Mrkt. distance	-0.050**	0.023	-0.011
Credit use	0.738*	0.443	0.120
Labor	0.085	0.113	0.018
Production	0.022**	0.010	0.005
Incomesqrt	0.058	0.058	0.012
Rice land size	0.221	0.431	0.047
TLU	-0.065	0.083	-0.014
Cooperative	0.371	0.244	0.085
Information	1.071***	0.241	0.275
Age2	0.000	0.000	0.000
Constant	0.110	1.132	

Log pseudo likelihood = -580.51422 P***<0.01, P**<0.05 andP * <0.1
Number of observation = 212
Wald Chi2 (14) = 66.33
Prob > chi2 = 0.0000
Source: own data, 2020

3.3. Determinants of the Quantity of Rice Marketed Supply (2nd Stage of Double Hurdle Model)

The quantity of rice marketed supply is significantly determined by 5 from 14 explanatory variables included in the model. The result of the second hurdle indicates that education level, credit use, labor, production and rice land size are the significant determinants of the quantity of rice marketed supply. The significant variables determining the quantity of rice marketed supply are distributed over the two categories of the covariates: socio-economic (educational level, labor, production and rice land size) and institutional (credit use) (Table 6).

Education level of the household head was expected to have a positive influence on the quantity of rice marketed supply. Besides, this study revealed that education level of the household heads positively influences the quantity of rice marketed supply and it was statistically significant at 5%. Hence, an increase in education level by one year would lead to an increase in the quantity of rice marketed supply by 0.42 quintals assumes that other things are constant. The implication for this result might be due to the new nature of the crop. Since rice is the newly introduced crop, better education level can have a paramount importance to rice production and market participation. Because the more the crop is new, the more it requires better education level. On the other hand, literates might be risk takers to produce surplus output and trust social modalities like cooperatives so that to sell their output through these collective groups. This result is consistent with the findings of [20].

Credit use was expected to have a positive influence on the quantity of rice marketed supply. The result showed that credit use is positively influence the quantity of rice marketed supply and it was statistically significant at 5%. Hence, using credit by rice producers cause a 2.422 quintals increase rice supply to the market. This means that credit services are the major sources to solve financial constraints that hinder the use of improved agricultural technologies. The implication might be linked with the labor demanding nature of the crop. Hence, the credit users might have an opportunity of hiring labor for weeding and other agricultural practices. Moreover, credit users may be forced to sell parts of their produce to repay the credit. This result is consistent with the finding of [16].

Labor was expected to have a positive influence on the quantity of rice marketed supply. The result showed that labor is positively influence the quantity of rice marketed supply and it was statistically significant at 5%. So, an increase in labor by one causes a 1.07 quintals increase in the amount of rice marketed supply. The implication might be related with the nature of rice cultivation. Rice production demands high level of labor so that to produce high level of output. From high level of production, surplus output to be supplied to the market is expected. Based on the finding by [21], the labor cost was the main cost item in rice production which took about 70% of the total variable cost.

In this study production was found to be positively influence the quantity of rice marketed supply and it was statistically significant at 1%. The result showed that a one quintal increase in the rice production causes a 0.301 quintals increase in the amount of rice marketed supply. It shows that farmers who produce more sell also more, which is consistent with the general expectation. This result is consistent with the findings of [22, 23, 4].

The result has shown that rice land size is positively influence the quantity of rice marketed supply and it was statistically significant at 5%. This means as cultivated rice land size is increasing, the amount of rice produced is increasing which may result in increase of rice supply to the market. The result showed that a one hectare increase in rice land size causes a 5.172 quintals increase in the amount of rice marketed supply. It showed that farmers who have more rice land size sell also more, which is fit with the general theory. The implication might be high output can be obtained from the largest size of rice land size. From high output, the

probability of having surplus product to be supplied to the market is high assumed that other things are constant. Additionally, the fragmented nature of rice land size might be a risk management mechanism that the condition of losing the whole quantities to be produced in the case of natural risks is low. Hence, the fragmented nature of the rice land size might increase farmer's level of market participation. The result is consistent with the finding of [24, 25].

Table 6. *Estimates of double hurdle model for quantity of rice supplied.*

Second hurdle (Tier 2)		
Variables	**Coeff**	**Robust St. Error**
Sex	1.030	1.483
Age	-0.030	0.044
Education	0.420**	0.185
HH size	0.030	0.269
Exper. Rice	0.036	0.092
Mrkt. distance	-0.003	0.100
Credit use	2.422**	1.216
Ext. Rice	1.707	1.393
Labor	1.070**	0.459
Production	0.301***	0.048
Incomesqrt	-0.069	0.267
Riceland	5.172**	2.246
Dista. Road	-0.081	0.330
Oxen. No.	0.247	0.599
Constant	-8.644*	4.719

Log pseudo likelihood = -502.84647 P***<0.01, P**<0.05 and P * <0.1
Number of observation = 166
Wald Chi2 (14) = 145.34
Prob > chi2 = 0.0000
Source: own data, 2020

4. Conclusion and Recommendations

This study results revealed 78.3% of farm households were participants and the remaining 21.7% were nonparticipants. It implies that the majority of the rice producers are market participants. The average amount of rice produce per sample household was estimated 30.92 quintals. Out of the produce, the volume of sold per sample household was estimated 9.56 quintals. This implies, the rice producer farmers consume more rice than they selling. It might be due to the increasing consumption pattern of rice in different forms like *injera,* bread and local drinks.

The result of the first hurdle model reveals that, market distance is negatively and significantly determines the probability of rice market participation. The assumption here is that, proximity of farmers to the market is important for timely output sell. This might be because of sampled households located far from market place will face high transaction costs which lead them for not to participate in rice market. On the other hand, credit use, production and access to market information are positively and significantly determine the probability of rice market participation. This indicated, households who use credit can have a financial strength to purchase quantity and quality enhancing rice technologies which can lead to have marketable produce. The quantity of rice produced is another determinant which influences the probability of market participation by rice producer farmers. Access to market information also influence the probability of market participation by rice producers positively and significantly. This implies, rice producers, who have access to price and buyer information have motivated to participate in the market.

On the other hand, the result of the second hurdle model shows that education level of the household head, credit use, labor, production and cultivated rice land size are positively and significantly determine the quantity of rice marketed supply. The implication for the positive and significant influence of educational level of the household head on the quantity of rice marketed supply can be related with the new nature of the crop. Credit use influences the quantity of rice marketed supply positively and significantly. The rice producer farmers are use credit for purchasing of improved rice varieties and hiring of labor which contributes to produce surplus rice for market. Active labor of the household head is influencing the quantity of rice marketed supply positively and significantly. It indicates, rice is labor demanding which requires cost which is highly used for weeding. Quantity of rice produced influences the quantity of rice marketed supply positively and significantly. This implies, from high amount of rice production the amount of rice to be sold can be increased which is in line with the general theory. It is suggested, rice market participation by the rice producer households could be increased by improving rural infrastructure (road), improving the quality of credit service delivery system of rural financial institutions like Amhara Credit and Saving Institution (ACSI), the district agricultural office needs to encourage the farmers to use yield enhancing rice technologies, improving existing market information systems by supplying timely information from district level to the kebeles, applying appropriate broadcasting mechanism (display boards and SMS), district agricultural office have to support farmers to have proper management of rice land to enhance rice production per unit area and providing both theoretical and practical training on rice cultivation for agricultural officers and rice producer farmers.

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