



SMALLHOLDERS MARKET PARTICIPATION OF RICE PRODUCTION IN FOGERA PLAIN, SOUTH GONDER ZONE, ETHIOPIA

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AUTHOR'S CONTRIBUTION

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Agriculture is the most important sector in the economy of Ethiopia. The growth of the sector depends upon the current subsistence-oriented production system is transformed into a market-oriented production system. However, in most cases, smallholder farmers find it difficult to participate in the market sufficiently because of numerous factors. This study was undertaken with the objectives of identifying the degree of market participation and the determinant factors of the different levels of market participation of smallholder rice farmers' in Fogera plain, South Gonder Zone, Ethiopia. The study used cross-sectional data collected from 205 randomly selected smallholder rice producer farmers from eleven kebeles through structured household questionnaires. The degree of market participation of the study area result reveals, on average 42% of the total rice produced was supplied to the market and it is much higher than the national average which is 38%. A multinomial probit regression model was used to analyze the determinant factors of the three categories of rice market participation by smallholder farmers. The result reveals the probability of being a subsistence farmer had affected positively and significantly by sex, age, lack of access to market information, and distance to the output market. Livestock ownership except oxen, education level, and hired labor expenditure had significantly affected with a negative sign. The probability of being a transitional farmer negatively influenced by age and lack of access to market information whereas the probability of being commercial farmers was positively influenced by educational status and number of oxen owned and negatively affected by household size and distance to the output market. The predicted probability result indicates that the majority of the sample household categorized under transition farmers which were 40 percent. Thus, strengthening institutions, market information delivery system and access to market have paramount implications to speed up the move of smallholder rice farmers' from subsistence and transitional towards commercial level of market participation.

Keywords: Smallholder farmer; degree of market participation; multinomial probit model; rice; fogera plain.

1. INTRODUCTION

Agriculture is the most important sector in Ethiopia; it accounts for 46% of GDP, 80% of export value, and about 73% of employment. The sector still remains largely dominated by rain-fed subsistence farming by

smallholders who cultivate an average land holding of less than a hectare. In development policy planning, transformation of smallholder agriculture to market oriented production system is agreed to be a solution for the existing problems of poverty and food security in the rural Ethiopia [1]. The involvement of

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smallholder farmers into markets can contribute to higher productivity and income growth, which in turn can enhance food security, poverty reduction and overall economic growth [2].

Promoting commercialization of agricultural production is a basis for the rural development of Ethiopia as well as many other developing countries. Policy makers in Ethiopia and elsewhere view that agricultural modernization, specialization and structural transformation of the economy towards more rapid and sustainable growth comes through agricultural commercialization process [3]. Where commercialization of smallholder farming received high government policy priority through GTP [4].

In Ethiopia, most of the rice produce comes from smallholder farmers. Despite agriculture to meaningfully contribute to economic growth, smallholder farmers have to commercialize their farming activities to produce marketable surpluses [5]. Agricultural commercialization usually takes a long transformation process from subsistence to semi-commercial and then to a fully commercialized agriculture [6].

The ultimate purpose of commercialization is poverty alleviation and economic development through income growth [7]. In order to improve the return of smallholders farmers from market participation, it is important to identify the factors that influence the level of their participation.

1.1 Objectives of the Study Were

- To determine the degree of market participation of rice producer farmers and;
- To determine the factors that influence the different level of market participation of smallholder rice producer farmers .

2. METHODOLOGY

2.1 Description of the Study Areas

The study was conducted in three districts of the Fogera plain namely Fogera, Libokemkem, and Dera districts of South Gonder Zone of Amhara National Regional State, Ethiopia. Crop livestock mixed farming system is a common practice in the area. The plain is flooded from the out flow of water from the two major rivers i.e Rib and Gumara that crosses many rice producing kebeles in the three districts. The two rivers have economic importance to the areas as they are used for irrigated crop production during the off season especially vegetable crops production.

2.2 Sampling Techniques

Multi-stage random sampling techniques were used to select districts, kebeles, and sample households. In the first stage, the three districts were selected purposively as Fogera plain is the major rice-producing hub in the country and the three districts are lay off in this hub. In the second stage, sample kebeles were selected randomly from rice-producing kebeles of each district based on the proportion to the size of rice-producing kebeles available in each district. In the third stage rice producer farm households selected randomly from each kebele.

2.3 Method of Data Collection

The study used both primary and secondary data sources. The primary data were collected from randomly selected rice-producing households. Cross-sectional data were collected from 222 rice producer farm households from the three districts. Out of the total 222 respondent households, only 205 rice producer farm household's data that participated in the rice market were used for this analysis.

2.4 Method of Data Analysis

Both descriptive statistics and econometric analysis were used to meet the specific objective of this study. Descriptive statistics was used to describe the socioeconomic characteristics and degree of output market participation index, whereas for econometric analysis multinomial probit model were use.

2.4.1 Crop output market participation /commercialization index

Crop output market participation/commercialization index defined as the proportion of the value of crop sales to total value of crop production, and the commercialization index is a continuous variable ranging between zero and one [8].

Crop-output market participation index, computed as follows:

$$MP_i \doteq \frac{\sum \bar{p}_r S_{ri}}{\sum \bar{p}_r Q_{ir}} \tag{1}$$

Where: S_{ri} is quantity of rice sold by household i evaluated at an average price rice (\bar{p}_r), Q_{ir} is total quantity of rice produced by household i .

The level of commercialization /market participation categorize smallholders as low commercial farmers if they sell only up to 25% of their produce, medium commercial farmers if the farm households sell 26-50% of their produce and considered as high

commercial farmers if the farm households sell 50% and more of their produce [9-10].

2.4.2 Multinomial probit model (MNP)

MNP model is used with discrete dependent variables that take on more than two outcomes that do not have a natural ordering. The stochastic error terms for this implementation of the model are assumed to have independent, standard normal distributions.

To use MNP, you must have one observation for each decision maker in the sample. The MNP model is frequently motivated using a latent-variable framework. The latent variable for the *j*th alternative, *j* = 1, . . . , *J*, is

$$\eta_{ij} = Z_i\alpha_j + \varepsilon_{ij} \tag{2}$$

where the $1 \times q$ row vector Z_i contains the observed independent variables for the *i*th decision maker. Associated with Z_i are the *J* vectors of regression coefficients α_j . The $\varepsilon_{i,1}, \dots, \varepsilon_{i,J}$ are distributed independently and identically standard normal.

The decision maker chooses the alternative *k* such that $\eta_{ik} \geq \eta_{im}$ for $m \neq k$. Suppose that case *i* chooses alternative *k*, and take the difference between latent variable η_{ik} and the *J* - 1 others:

$$\begin{aligned} V_{ijk} &= \eta_{ij} - \eta_{ik} \\ &= Z_i(\alpha_j - \alpha_k) + \varepsilon_{ij} - \varepsilon_{ik} \\ &= Z_i\gamma_j + \varepsilon_{ij} \end{aligned} \tag{3}$$

where $j' = j$ if $j < k$ and $j' = j-1$ if $j > k$ so that $j' = 1, \dots, J-1$. $\text{Var}(\varepsilon_{ij'}) = \text{Var}(\varepsilon_{ij} - \varepsilon_{ik}) = 2$ and $\text{Cov}(\varepsilon_{ij'}, \varepsilon_{il'}) = 1$ for $j' \neq l'$. The probability that alternative *k* is chosen is

$$\begin{aligned} \text{Pr}(i \text{ chooses } k) &= \text{Pr}(V_{i1k} \leq 0, \dots, V_{i,J-1,k} \leq 0) \\ &= \text{Pr}(\varepsilon_{i1} \leq -Z_i\gamma_1, \dots, \varepsilon_{i,J-1} \leq -Z_i\gamma_{J-1}) \end{aligned} \tag{4}$$

Hence, evaluating the likelihood function involves computing probabilities from the multivariate normal distribution [11] and [12].

In (1), not all *J* of the α_j are identifiable. To remove the indeterminacy, α_l is set to the zero vector, where *l* is the base outcome as specified in the base outcome () option. That fixes the $l_{t \square}$ latent variable to zero so that the remaining variables measure the attractiveness of the other alternatives relative to the base.

2.5 Hypothesis

In setting hypothesis, in the course of identifying the determinant factors influencing the level of market participation, the main interest is to analyze which factors that differentiate the level of participation of households. The expected sign and value of potential variables, which were supposed to influence the level of market participation of rice producer households are explained below (Table 1).

Table 1. Hypothesized variable with expected sign

Variables	Value	Expected sign
Dependent variable		
Level of market participation	1=subsistence, 2= transitional 3= commercial	
Independent variables		
Sex of household head	0= Female, 1=Male	+
Age of household head	Years	-
Education status	0= illiterate 1= literate	+
Household size	Number	-
No. oxen owned	Number	+
Number of livestock owned except oxen	TLU	-
Land size	Hectare	+
Input expenditure	Birr*	+
Use of Hired labor	1=use 0= otherwise	+
Membership in cooperative.	1=member, 0= otherwise	+
Extension	1=Access, 0=otherwise	+
Lack of market information	1= Access= 0= otherwise	-

*Birr: it is the unit of currency in Ethiopia

3. RESULTS AND DISCUSSION

3.1 Descriptive Statistics

Descriptive statistics were used to analyze the data to have a clear understanding of the socioeconomic, institutional, and other characteristics of the households in addition to the econometric model.

3.1.1 Socioeconomic characteristic of sample household

Socioeconomic characteristics of household heads such sex, age, education, household size, livestock ownership except oxen, cultivated land owned, number of oxen owned, input expenditure, use of hired labor, distance to the nearest market, membership in cooperative, access to market information and access to extension service in the study areas were analyzed. The result reveals the average age of the sample household was 41.4 years with a household size of 6.53 person. Livestock are an important and a major asset for households in the study area. They are used as a source of draft power for cultivation, food, income, transporting loads and human beings, and manure for organic fertilizer and domestic fuel supply. On average household had owned 5.7 TLU except oxen and 2 oxen. Regarding cultivated land, 1.29 hectares of land had owned by an average rice producer farmers of which 0.8 hectares of cultivated land were allocated for rice production in the study area.

To improve the productivity of produces, inputs are an important influencing factor that leads to the

increase of the production and supply to the market. Farmers in the study area were expended money for the purchase of inputs like fertilizer and seed. An average farmer expends 1206 Birr per hectare for the purchase of inputs in rice cultivation. Nearness to the market is expected to reduce marketing costs and thus encourage market participation. Households in the study area are located on average 9 kilometers away from the nearest market. Regarding the discrete variables, 96% of the households were male-headed, the educational status of the head 60 % of them was literate (read and write, and above). and 91 % of households were used hired labor at least in one of rice cultivation operations. Regarding agricultural extension contact, 90% of the household had access, 72% member of cooperative, and 22% lack market information (Table 2).

3.1.2 Degree of market participation of rice in fogera plain

The result showed that on average 42% of the produced rice was sold. while the rest 58% consumed at home as food and used for seed source. From this it can be seen that the degree of market participation in the Fogera plain is much higher than the national average which is 38% [13]. The possible reason for this was that in the study area rice was the major crop and farmers were allocated most of their lands for rice production and the higher productivity nature of the crop provides an opportunity for surplus production. Based on the categorization of market participation level in the study area rice producer farmers are categorized under medium commercial or transitional [9-10,14].

Table 2. Socioeconomic characteristics of sample households

Continuous Variables	Mean	SDE
Age	41.4	0.80
Household size	6.53	0.18
Livestock owned except oxen	5.7	0.21
Cultivated land size owned	1.29	0.05
Land allocated for rice production	0.8	0.03
Number of oxen Owned	1.97	0.06
Input expenditure	1206	73
Distance to nearest market	8.94	0.34
Discrete variables	Frequency	% age
Sex of household head	195	96
Education status of household head	123	60
Lack of access to market information	46	22
Use of hired labor	186	91
Membership in cooperative	147	72
Access to extension contact	184	90

Source: own calculation

3.2 Multinomial Probit Model Results

Multinomial probit model was used to determine the influencing factor at different level of market participation. According to [9-10,14] the proportion of value sold up to 25 percent considered as subsistence farmers, between 25-50 percent the proportion of value sold categorized as transitional farmer and greater than 50 percent of proportion of value sold categorized as commercial farmer. Based on these categories, the determinant factors of different level of market participation of households identified and discussed below.

The Wald χ^2 test value of 48.42 which is highly significant ($P < 0.000$), suggesting the model has strong explanatory power. The maximum likelihood estimate for the multinomial probit regression for the probability of being commercial, subsistence and transitional as transitional farmers were taken as base outcome by default due to the majority of the farm households were laid in this category.

3.2.1 Determinant factors of level of market participation of households

The result of the MNP regression reveals, the probability being commercial farmers were positively influenced by educational status and number of livestock owned however, negatively affected by household size and distance to the output market. The probability of being a transitional farmer negatively influenced by age and lack of access to market information and positively affected by household size. The probability being subsistence had affected significantly by sex, age, lack of access to market information and distance to the output market with positive sign and significantly affected by number of oxen owned, education level, and hired labor expenditure with negative sign (Table 3).

Sex of the household head: Being female headed household increases the probability of being subsistence farmer by 28%. The result is consistent with other previous research. A study conducted by [14] showed that women likely to store more output for household self-sufficiency.

Age of household head: An increase in age by one year significantly increases the probability of being subsistence farmer by 0.8% where as it has negative effect on being transition farmer by 0.7%. This could arise from the fact that older heads have limited access to market information; whereas younger heads could sell a relatively large portion of their produce through a better access to market information. The finding confirms [15] The age of household

head negatively influences quantity supplied to the market.

Education of household head: An increase in the educational level of household head by one unit significantly decrease the probability being subsistence farmer by 1.2% and increases the probability being commercial farmer 1.7%. The implication is that education equip individual in acquiring knowledge and skill and accept new ideas and innovations, and easy to get supply, demand and price information and this helps farmer to enhances to produce more and increase volume of sales. The result is consistent with other previous works. A study conducted by [16-19] states that education increases intensity of market participation by improving the ability of farmers to analyze information and thereby improving farmers marketing performance.

Household size: An increase in household size by one unit significantly increase the probability being transitional farmer by 4.5% and decreases the probability being commercial farmer by 5.8%. The implication is that the larger the size of household the more they will consume their produce and fail to produce marketable surplus beyond household consumption needs. These results are consistent with the finding of [17-18,22] showed that household size is negatively associated with the intensity of market participation.

Number of oxen owned: An increase in the number of oxen owned by one unit significantly decrease the probability being subsistence farmer by 9%. Ox is a critical production asset in smallholder farm households having a direct effect on the production of rice and thereby marketable surplus with a significant amount. Asset endowments have higher probability of market participation and higher sale volume [23]. Thus, it has a positive effect on market participation and volume sale.

Tropical Livestock unit: An increase in ownership of livestock by one unit significantly increases the probability of being commercial farmer by 2.9%. The implication is that cash income obtained from livestock can be used to purchase crop production inputs and may lead to improve productivity there by increase marketable surplus.

Use of hired labor: Has a significant negative effect on being subsistence farmer. A unit increase in the use of hired labor decreases significantly the probability of being subsistence farmer by 25%. This implies that family labor is the main source of labor for subsistence farmer. The result is in line with [18] showed that commercial farmers are relay on hired labor not just family resource

Table 3. Marginal effects of explanatory variables on the probability of different market participation

Variables	Subsistence			Transitional			Commercial		
	Mfx	SDE	P> Z	Mfx	SDE	P> Z	Mfx	SDE	P> Z
Sex of household head	0.275	0.162	0.090*	-0.256	0.212	0.228	-0.019	0.159	0.906
Age of household head	0.008	0.002	0.004***	-0.007	0.003	0.028**	-0.000	0.002	0.744
Educational status	-0.012	0.062	0.056*	-0.005	0.007	0.434	0.017	0.005	0.001***
Household size	0.013	0.014	0.362	0.045	0.015	0.004***	-0.058	0.013	0.000***
No. oxen owned	-0.089	0.0421	0.033**	0.036	0.044	0.416	0.053	0.036	0.140
TLU except oxen	-0.017	0.014	0.225	0.011	0.015	0.449	0.029	0.012	0.015**
Land size	-0.041	0.047	0.377	0.001	0.053	0.978	-0.043	0.043	0.326
Input expenditure	0.000	0.000	0.340	0.000	0.000	0.561	0.000	0.000	0.696
Hired labor Expenditure	-0.252	0.106	0.017**	0.135	0.124	0.279	0.117	0.115	0.310
Membership in coop.	-0.006	0.071	0.927	-0.017	0.078	0.824	0.023	0.065	0.714
Extension contact	-0.107	0.105	0.305	-0.000	0.124	0.995	0.108	0.123	0.380
Lack of access to market information	0.168	0.067	0.013**	-0.241	0.078	0.002***	0.072	0.064	0.256
Distance to the output market	0.011	0.006	0.055*	-0.001	0.006	0.853	-0.010	0.005	0.065*

Source: Model result ***, **, * 1%, 5% and 10% significance level

Table 4. Predicted probability of market participation level

Variable	Obs	Mean	SD
P1(Subsistence)	205	0.3607	0.2198
P2(Transitional)	205	0.3998	0.1537
P3(Commercial)	205	0.2393	0.1599

Source: model result

Lack of access to market information: An increase in lack of access to market information positively affects the probability of being subsistence farmer by 17% and negatively affects the probability being the transitional by 24 %. Access to market information helps farmers for decision making on the size of sold by providing information on the demand, supply and price of produce [18,21]. Result showed that market information and the quantity of produce sold have positive relation.

Distance to the nearest market: An increase in distance to the output market significantly increases the probability being subsistence farmers by 1.1% and negatively affects the probability being commercial farmer by 1%. The implication is that as the distance to market increases, the transaction cost of output sold increases this may lead to decline in the amount of money received by the farmer from sell of output. The result is consistent with the findings of [20] showed that as the distance from the nearest market increases, variable transport costs increase and this discourages smallholder farmers from selling high volumes of produce.

The probability of market participation of rice producer farmers can be computed by predicting the probability of each outcome. Accordingly, the likelihood of the rice producer farmers to be subsistence in market participation based on the proportion of value sold were 36 % while the predicted probability of transitional and commercial rice producer farmers were of 40 % and 24%, respectively. The probabilities of all outcomes add to 100%. The results generally suggest that the majority of rice producer farmers in the study area categorized under transitional class based on the proportion of value of sold while it is less likely in commercial (Table 4).

4. SUMMARY AND CONCLUSION

The purpose of this study was to determine the factors which differentiate the level of market participation of rice farmers. The descriptive statistic result showed that market participation level were categorized in to three group, based on the proportion of value sold viz the subsistence up to 25 percent, transitional between 25-50 percent and commercial greater than 50

percent. The degree of market participation index indicates 42 % of the total produce were supplied to the market lied in the transitional categories of market participation based on the proportion of value sold, This implies that farmers in the study area produce rice for both consumption and market purpose. The multinomial probit regression model was also used to determine the factors which influence the probability being commercial farmer based on market participation. The result showed education level & livestock owned positively and distance to output market and household size negatively affects the probability being commercial farmer. Therefore, it was concluded that accessibility of education service and access to market have paramount implications to speed up the move from transitional towards commercial oriented production decision as the majority of households are categorized under transitional or medium commercialization level in the study area.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Habtamu Yesigat, Impact of input and output market development interventions: A case of Improving Productivity and Market Success (IPMS) Project in Bure District, International Journal of Sustainable Economies Management. 2012;1(1):39-51.
2. Barrett C.B. Smallholder market participation: concepts and evidence from eastern and southern Africa. Food Policy. 2008;299-317.
3. Pender, J. and Dawit Alemu. Determinants of smallholder commercialization of food crops: Theory and evidence from Ethiopia. IFPRI Discussion Papers, No. 75. International Food Policy Research Institute (IFPRI), Washington DC, USA; 2007.

4. MoFED (Ministry of Finance and Economic Development). Growth and Transformation Plan (GTP). Addis Ababa. 2010;I,II.
5. Jagwe J, Machethe C, Ouma E. Transaction costs and smallholder farmers' participation in banana markets in the Great Lakes Region of Burundi, Rwanda and the Democratic Republic of Congo. *Africa Journal of Agricultural Research*. 2010;6(1):1-16.
6. Pingali PL, Rosegrant MW. Agricultural commercialization and diversification Process and policies. *Food Policy*. 1995;20(3):171-185.
7. Zhou S, Minde IJ, Mtigwe B. Smallholder agricultural commercialization for income growth and poverty alleviation in southern Africa a Review. *Africa Journal of Agricultural Research*. 2013;8(22):2599-2608.
8. Von Braun J, Bouis H, Kennedy E. Conceptual framework. In: Von braun j and kennedy e. (eds), agricultural commercialization, economic development and nutrition. John Hopkins University Press, Baltimore, Maryland, USA. 1994;9-33.
9. Goitom Abera. Commercialization of smallholder farming: Determinants and welfare outcomes a cross-sectional study in Enderta District, Tigray, Ethiopia. An MSc Thesis Presented to the University of Agder, Kristiansand, Norway; 2009.
10. Musah AB, Osei-Asare Yaw Bonsu, Wayo Seini. Market participation of smallholder maize farmers in the upper west region of Ghana. 2014;9(31):2427-2435.
11. Cameron AC, Trivedi PK. *Microeconometrics: Methods and Applications*. New York: Cambridge University Press; 2005.
12. Long JS, Freese J. *Regression models for categorical dependent variables using stata*. 3rd ed. CollegeStation, TX: Stata Press; 2014.
13. The Federal Democratic Republic of Ethiopia, Central statistic Agency Agricultural Sample survey. Crop and Livestock Product Utilization. *Statistical Bulletin*. 2020;588.
14. Leykun BD, Jemma H. Econometric analysis of factors affecting market participation of smallholder farming in Central Ethiopia. *Journal of Agricultural Economics, Extension and Rural Development*. 2014; 2(6):094-104.
15. Mirie T, Zemedu L. Determinants of Market Participation and Intensity of Marketed Surplus Among Teff Producers in Dera District of South Gondar Zone, Ethiopia. *Journal of Development and Agricultural Economics*. 2018;10(10):359-366.
16. Aman T, Adam B, Lemma Z. Determinants of smallholder commercialization of horticultural crops in Gemechis District, West Hararghe Zone, Ethiopia. *African Journal of Agricultural Research*. 2014;9(3): 310-319.
17. Takele H, Endrias G, Amsalu M. Determinants of intensity of market participation of smallholder mango producers: The case of boloso bombe Woreda, Wolaita Zone, Southern Ethiopia. *Journal of Marketing and Consumer Research*. 2017;32:2017.
18. Ibrahim A, Beyene T, Tinsae D. Determinants of intensity of market participation of smallholder rice producers: The case of Shebe Sombo District, Southwest Ethiopia. *Journal of Agricultural Economics and Development*. 2018;7(3):013-022.
19. Dubale Abate, Yonnas Addis. Factors affecting the intensity of market participation of smallholder sheep producers in northern Ethiopia: Poisson regression approach, *Cogent Food & Agriculture*. 2021;7(1).
20. Efa GT, Degye G, Tinsae D, Tadesse K. Determinants of market participation and intensity of marketed surplus of teff producers in Bacho and Dawo Districts of Oromia State, Ethiopia. *Journal of Economics and Sustainable Development*. 2016;7(1).
21. Musah AB, Bonsu OAY, Seini W. Market participation of smallholder maize farmers in the upper West Region of Ghana. *African Journal of Agricultural Research*. 2014; 9(31):2427-2435.
22. Yallew Mazengia. Smallholders commercialization of maize production in Guangua district, northwestern Ethiopia. *An International Scientific Journal*. 2016;58:65-83.
23. Barrett CB. Smallholder market participation: concepts and evidence from Eastern and Southern Africa. *Food Policy*, Forthcoming; 2007.