Analysis of Factors Influencing Market Supply of Rice by Smallholder Farmers in Guraferda District, Southwest Ethiopia

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Abstract: Rice is among the most important cereals grown in different parts of Ethiopia as food crop. The country is characterized with immense potentials for growing the crop. This study was aimed to identify factors determining market supply of rice by smallholder farmers in Guraferda District, Southwest Ethiopia. Primary and secondary data were used for the study. The data were collected from 120 rice producer farmers selected through three stage sampling technique. Econometric model was used for the analysis of the data. Multiple linear regression model results indicated that land under rice, family size, lagged price of rice and number of oxen significantly affects quantity of rice supplied to the market. Quantity supply of rice could be enhanced through adequate supply of improved varieties, controlling of disease and pests, important to make youth participate in to rice production and marketing activities, developing market information system and encouraged farmers to have their own oxen.

Keywords: Supply, Multiple Regression, Rice, Guraferda

1. Introduction

Rice was introduced to Ethiopia in the 1970s and has since them cultivated in small pockets of the country [1]. It is among the most important cereals grown in different parts of Ethiopia as food crop. The country is characterized with immense potentials for growing the crop [2]. Area rose from 6,241 hectare in 2005 to 48,418.09 hectare in 2017 and paddy production from 112,443 quintal to 1,360,007.26 quintal. At the same time, the number of rice farmers increased from 22,496 to 150,041 [3].

Until a few years ago, the staple food crops in Ethiopia were maize, wheat, sorghum, and *Teff*-a fine grain unique to the country, which is used for making "*injera,*" a traditional Ethiopian bread. Rice started to be recognized in the country because of its good productivity. Rice is now a major livelihood option for farmers in Ethiopia and an important crop for the country's food security available labor, and vast areas suitable for both rain fed and irrigated systems. Rice has also become popular because it can be used to make many valuable by-products, such as rice husk, rice bran, and beer. It can also partially or fully replace *teff* in the making of *injera* [4].

The development aspect in promoting rice production is also limited to certain areas. However, there is an increasing trend in both area and production of the crop since 2006. Out of the total national production of rice in 2017, about 107,911 ton is produced in Amhara Regional State, 13,813 ton in Oromia and 7,408 ton Southern Region [3].

Marketing is a major activity in the rice production system. It involves a sequence of production actions from the harvesting of paddy rice to milling and ultimate sale, when it is priced, promoted and distributed to consumers. There are documented evidence of the major constraints of rice production and marketing in Ethiopia. According to EUCORD the major constraint in rice production is poor access to improved rice varieties, limited participation of seed growers in the production and marketing of rice seed,

poor access and use of modern postharvest techniques and equipment, grassy weeds, insect pests and shortage of labor specifically during periods of intensive weeding [5]. MoARD states that poor knowledge of the producers and other market actors about rice product quality, limited access to rice market information, limited group marketing options, limited use of storage as marketing strategy and price seasonality are identified as major constraints in rice marketing [6].

Similarly, [7] identified shortage of land, lack of improved varieties, low output price, poor transportation facilities, lack of market, lack of capital and credit availability as the problems of agricultural production and marketing confronting rice producers in Fogera district. Other problems associated with agricultural produce marketing on the same area as reported by [8] include unavailability of sufficient processing facility, distress sale of rice immediately after harvest, low quality of rice and shortage of rainwater.

These studies have provided evidences that rice production and marketing is often associated with several problems in Ethiopia. However, recent information on intensity of rice market supply has not been studied in Guraferdea District. It is based on this backdrop that this study attempts to fill this research gap.

2. Research Methodology

2.1. Description of the Study Area

The study was conducted in Guraferda district. It is one of the districts in Southern Nations, and Peoples' Regional State Bench Maji zone. The district center is Biftu which is at about 603 km away from south west of Addis Ababa and 42 km from the zone capital Mizan. It covers a total area of 228,281ha. The district is bordered on the south by Bero, on the west and north by Gambela region, on the northeast by Sheko, on the east by Debub Bench, and on the southeast by Meinit Shasha. There are 22 Kebeles in the District [9]. The total population of the District in the year 2014 was estimated to reach 43,137. Out of the total population 54.42% and 45.58% are male and female respectively [10]. Geographically, it is positioned between 6°49'33"-6°58'06"N latitude and 35°07'03"-35°25'02"E longitude [11].

Agro-climatic zones of Gurafarda are lowland (Moist Qolla) and medium (Wäynadäga), which constitute 78.25% and 21.75% respectively. The altitude ranges from 700 to 1995 meters above sea level. The mean annual rainfall of the study area is between 1500-2400mm. The area receives highest rainfall in October and the lowest in February. In the area the peak monthly temperature is maintained in months of March and October. Average monthly temperature of the study area is 25°C [9].

2.2. Types, Sources and Methods of Data Collection

Primary and secondary data were used for the study. Primary data was collected from rice producer farmers through personal interviews using semi structured questionnaire. The secondary data on population size of the study areas, lists of rice producers and agro-climatic condition of the study area were taken from the Guraferda District Agriculture Office, Agricultural Research Center, CSA reports and other Non-Governmental Organizations who are involved in rice research and development activities in the study area and from web sites.

2.3. Sample Size and Sampling Method

In this study, the district was selected purposively for being the only rice producing area in Benchi Maji Zone. Three stage sampling technique was used to draw the sample. In the first stage, with the consultation of Guraferda District Agricultural Office experts, 22 *kebeles* were stratified into rice producer and non-producer. In the second stage, among 18 rice producing *kebeles*, 5 *kebeles*, were selected through simple random sampling. In the third stage, from the total rice producer list of sampled *kebeles* 120 rice producer household heads were selected randomly based on probability proportional to size sampling technique.

A simplified formula provided by [12] was used to determine the required sample size.

$$n = \frac{N}{1 + N(e)^2} = \frac{5584}{1 + 5584(0.09)^2} \sim 120$$

Where n = sample size

N = Total number of rice producer household heads in 18 rice producing *kebeles* (5584)

e = level of precision (9%)

Table 1. *Distribution of sample households across sample kebeles.*

Sample kebeles	Total number of rice farmers	Sampled farmers	
		Number	**Proportion (%)**
Kuja	348	28	23.33
Alenga	474	39	32.5
Berji	246	20	16.67
Semerta	301	24	20
Dankila	107	9	7.5
Total	1476	120	100

Source: [9].

2.4. Econometric Analysis

In this part of the analysis factors determining rice market supply was analyzed by using multiple linear regression model. The model used for the analysis is specified as stated in [13]:

$$Y_i = X_i\beta + U_i \tag{1}$$

Where Y_i - Quantity supply of rice in quintal (log-normalized)

X_i - A vector of explanatory variable, and 'i' is 1, 2, 3… n

β - Coefficient of ith independent variable

U_i - Unobserved disturbance term

The three most important diagnostic tests after OLS,

multicollinearity, heteroscedasticity and specification were conducted. According to [14], multicollinearity refers to a situation where it becomes difficult to identify the separate effect of independent variables on the dependent variable because of existing strong relationship among them. It leads to unreliable and unstable estimates of regression coefficients. In this study, VIF is used to check multicollinearity among independent variables. As a rule of thumb, Gujarati (2003) stated that if the VIF value of a variable exceeds 10, which will happen if R_j^2 exceeds 0.90, then, that variable is said to be highly collinear. That means, the larger the value of R_j^2 is the higher the value of $VIF(X_i)$ causing higher collinearity in the variable (X_i). The $VIF(X_i)$ is computed as follows:

$$VIF(X_i) = \frac{1}{(1 - R_j^2)} \quad (2)$$

Where, R_j^2 is the multiple correlation coefficients between explanatory variables.

One of the important assumptions of the classical linear regression model is that the variance of each disturbance term ui conditional on the chosen values of the explanatory variables is some constant number equal to σ^2. This is the assumption of homoscedasticity [14]. Breaking this assumption means that OLS estimators are not the Best Linear Unbiased Estimators (BLUE) and their variance is not the lowest of all other unbiased estimators. Therefore, it is important to check the presence of heteroscedasticity using Breush-Pagan test in this study [13].

The biggest source of harm from misspecification is omitting a relevant variable (or an incorrect functional form that mimics the omitted variable problem) that is correlated with one or more of the included RHS variables. If the omitted variable is not correlated with one of the RHS variables, then the OLS coefficient estimates remain unbiased. In this study, specification test for omitted variable was checked using Ramsey RESET test. One advantage of RESET is that it is easy to apply, for it does not require one to specify what the alternative model is [14].

3. Results and Discussion

Multiple linear regression model was employed to identify factors affecting rice market supply. The three most important diagnostic tests were carried out, multicollinearity, heteroscedasticity and model specification tests were conducted.

The existence of multicollinearity problem was tested using variance inflation factor (VIF). The results of all VIF values ranges between 1.05 and 1.61 and with mean VIF value is 1.32. These results indicated there is no serious multicollinearity problem among independent variables. Heteroscedasticity problem was tested using Brush pagan test. The result indicated that absence of heteroscedasticity problem in the model. Specification test for omission of relevant variable was tested using the Ramsey RESET test. The result indicates model does not have omitted variables bias at 5% significant level.

Results of multiple linear regression model is presented in Table 2 below. Out of hypothesized ten variables, four variables family size, land under rice, lagged price of rice, and number of oxen owned significantly affected quantity of rice supply. The overall goodness of fit of the regression model is measured by the coefficient of determination (R^2).

The adjusted R^2 value of the model is 0.54. This means about 54% of the total variation in the rice market supply is explained by explanatory variables. The significant variables are described as follows:

***Table 2.** OLS estimation of determinants of quantity supply of rice (log).*

Variables	Coefficients	Std. Err.
(Constant)	-0.724	0.968
Sex of HH	-0.091	0.140
Education Level	0.016	0.014
Family size	-0.042**	0.019
Annual non-farm income (log)	0.012	0.014
Land under rice (ha)	0.648***	0.102
Lagged price of rice (log)	0.419**	0.170
Number of oxen owned	0.203***	0.055
Rice farming experience (yrs)	0.008	0.005
Distance to nearest market (hrs)	0.014	0.021
Credit access	0.055	0.100
Number of observation	120	
F (10, 109)	15.03	
Prob>F	0.0000***	
R-squared	0.5796	
Adj R-squared	0.5411	

Source: Survey result, 2018.
Note: Dependent variable- is log of quantity of rice supplied to the market.
*** Significant at 1% level of significance and ** Significant at 5% level of significance.

Family size: The model result clearly shows family size had negative relationship with the rice quantity supplied and it was significant at 5% significant level. The negative and significant relationship indicates that larger family size

consumed high proportion of rice produce as a result quantity of rice supplied would be decreased. Thus, as family size increase by one unit rice consumption at home increase and therefore the quantity of rice supplied decrease by 4.2%, holding all other variables constant. This finding agrees with the study conducted by [15] indicated that quantity supply of onion decreased as the number of family members increased.

Land under rice: Land under rice positively contributed in rice quantity supplied to the market and it was significant at 1% significant level. The positive coefficient of land under rice implies that a one hectare increase in land allocated for rice leads to the rice quantity supplied increased by 64.8%, holding all other variables constant. Since rice is one of major cash crop in the study area. Any additional allocation of land for rice can increases quantity of rice supplied to market. This finding is similar to those of [16, 17] who found that the area of land allocated for sesame and cotton production positively affected the market supply of these crops respectively.

Lagged price of rice (log): Lagged price of rice positively affect the quantity of rice supplied and it was significant at 5% significant level. The positive coefficient implies that a 1% increase in previous year rice price resulted in an increase in rice quantity supplied by 41.9%, holding all other variables constant. Thus, the price of rice in 2016/17 can stimulate production and thus increase quantity of rice supplied in 2017/18. The study conducted by [18] indicated that market supply of red pepper positively and significantly affected by its lagged market price. Similarly, [8] found lagged price has direct relationship to the next year rice supplied to the market.

Number of oxen owned: The number of oxen owned by household positively affects quantity of rice supplied to the market and it was significant at 1% significant level. This implies that a one unit increase in number of oxen owned by household resulted in 20.3% increase in quantity of rice supplied. A study conducted by [17] found that number of oxen owned by household positively affected market supply of cotton in Metema District. Similarly, study conducted by [15] identified that number of oxen owned positively related to volume of tomato and onion supplied to market.

4. Conclusion and Recommendations

Rice is one of major cash crops in Guraferda District. All sampled farmers supplied rice produce to the market in 2017/18 production season. Therefore, the study focused on intensity of rice market supply.

Based on findings of the study, the following recommendations are suggested to be considered in future intervention strategies, which are aimed at increase rice market supply. The result of econometric analysis indicated that land under rice has affected rice quantity supplied positively and significantly. Since, land under rice is as a proxy measure of quantity of rice produced. The area used for rice production is difficult to increase due to its limited resource. Therefore, it is better to increase the productivity of rice. Adequate supply of improved varieties, controlling of disease and pests and use of optimum input should be applicable to increase the productivity of rice and its supply to the market. Family size affected quantity supply of rice negatively and significantly. Within limited production the household who have larger family size tends to consume at home more than they contribute to the production and sales of the rice and thus the quantity of rice supplied decrease. Therefore, important to make youth participate in to rice production and marketing activities. Lagged price of rice has affected quantity supplied of rice positively and significantly. Therefore, developing a market information system about rice market would help the rice producers in making marketing decisions. Oxen are one of the inputs used for rice production and number of oxen owned by households affected quantity of rice supplied positively and significantly. Smallholder farmers who own more oxen are more likely to supply more rice to the market. Therefore, there is a need to facilitate farmers to own oxen so as to accomplish farming operations on time and increase production and market supply of rice.

References

[1] Negussie Shoatatek Zenna, Zewdie Gebre-Tsadik and Tareke Berhe. 2008. *Moving up in Ethiopia*. Rice Today, October-December 2008.

[2] NRDSE (National Rice Development Strategy of Ethiopia). 2009. Annual report April 13-17/2009. NRDSE, Kampala Uganda.

[3] CSA (Central Statistical Agency). 2017. Sample Survey Results. Volume I: Statistical Report on Area and Production of Major Crops (Private Peasant Holdings, Meher Season): CSA, Addis Ababa, Ethiopia.

[4] Mohapatra, S. 2012. Ethiopia's millennium crop. Rice today January-March 2012 in Addis Ababa, Ethiopia.

[5] EUCORD (European Cooperative for Rural Development). 2012. Rice Sector Development in Eastern Africa: A Desk Study Prepared for the Common Fund for Commodities. EUCORD, Kampala, Uganda.

[6] MoARD (Ministry of Agriculture and Rural Development). 2010. National Rice Research and Development Strategy. MoARD, Addis Ababa, Ethiopia.

[7] Astewel Takele. 2010. Analysis of rice profitability and marketing chain: The case of Fogera, woreda, South Gondar zone, Amhara National Regional State, Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

[8] Wolelaw Sendeku. 2005. Factors determining supply of rice: A study in Fogera district of Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

[9] GDAO (Gurafereda District Agricultural Office). 2018. Annual report of the District. Gurafereda, Southwestern, Ethiopia.

[10] CSA (Central Statistical Agency). 2013. Population Projection of Ethiopia for All Regions at Wereda Level from 2014-2017. CSA, Addis Ababa, Ethiopia.

[11] Belay Haile. 2009. Resettlement induced land use changes and their impact on non-timber products production. MA Thesis, Addis Ababa University, Addis Ababa, Ethiopia.

[12] Yamane Taro. 1967. *Statistics: An Introductory Analysis, 2nd Edition*. Harper and Row, New York.

[13] Greene, W. H., 2002. *Econometric Analysis, 5th Edition*. Prentice Hall, Inc, London.

[14] Gujarati, D. N. 2003. *Basic Econometrics, 4th Edition*. McGraw-Hill, New York, USA.

[15] Abay Akalu. 2007. Vegetable market chain analysis in Amhara National Regional State: The case of Fogera Woreda, South Gondar Zone. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

[16] Kindie Aysheshm. 2007. Sesame market chain analysis: The case of Metema Woreda, North Gondar Zone, Amhara National Regional State. MSc Thesis Haramaya University, Haramaya, Ethiopia.

[17] Bosena Tegegne. 2008. Analysis of cotton marketing chains: The case of Metema Woreda, North Gondar Zone, Amhara National Regional State. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

[18] Alemnew Abay. 2010. Market chain analysis of red pepper: The case of Bure woreda, West Gojjam zone, Amhara National Regional State, Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.