Original Research Article

A Study on factors influencing the market participation decision of Paddy farmers in Odisha

ABSTRACT

This paper explores the market participation decision of farmers in Odisha and explains the vital factors that influence the farmers' decision to participate in the market in Odisha. To study the relationship between the farmers' decision to participate in the market and the factors influencing these farmers' decision, a Probit regression model is used. The study uses primary data collected from 320 farmers of Ganjam, Kalahandi, Bargarh and Mayurbhanj District of Odisha. It is found that farm size, household labour, level of income and farm income are the main factors affecting the farmers' decision to participate in the market. The study examines the phenomenon of paddy farmers in Odisha from the perspectives of market participation. The results of this study have implications as to what factors need to be addressed to encourage paddy farmers of Odisha to participate in the market. We suggest that Odisha government and policymakers need to establish balanced policies for farmers and manage them in an appropriate way so that development can be fostered, contributing to food security, value addition and overall economic development.

Keywords: Paddy farmers, market participation, probit model

INTRODUCTION

Market participation of farmers is the consequence of economic development. It ensures better income and improved food security. The existence of markets and improved market access are important for farmers as it promotes overall agricultural and economic development. Improved access to markets is important to increase market participation and the extent of their participation. Farmers involved in traditional food crops depend on informal markets due to weak linkages with formal markets. However, the participation rate of paddy farmers in the rice market remains low due to various constraints. They lack reliable market information. Due to their small surpluses in production, paddy farmers are generally exposed to a higher degree of risk and transaction costs. Their decisions on the amount of output to sell are mainly influenced by marketing information, prices of the produce, and distance to the market. Therefore, studying the market participation of rice farmers in Odisha can provide useful implications in the direction of future research.

Odisha stands 4th in production (7.58 million tonnes) and the area under coverage (4.18 million hectares, 2013-14) of paddy in India. In Odisha, many varieties of paddy (Hybrid/HYV / Indigenous) are cultivated in almost all districts due to the suitability of agro climatic conditions. Out of 4.18 million hectares of Paddy acreage, the area under HYV is 3.71 million ha (88.8%) while 0.47 million ha (11.2%) is covered under local varieties. In view of decline in the share of Agriculture and Allied Sector to the state GDP (15.4%), agrarian distress, non-remunerative paddy farming, higher food grain prices and lower MSP, it would be reasonable to analyze value chain of paddy to know share of paddy farmer in the value chain for corrective action to strengthen the share. The value chain describes the sum total of activities required to move a commodity from the initial point of production to the final point of consumption.

MATERIALS AND METHODS

Odisha is divided into 4 Physiographic zones i.e. Coastal plains, Eastern Ghats, Central table-lands and Northern plateausbased on cropping pattern, soil types & rainfall. This study was conducted in this region. For this study, multi stage random sampling procedure was followed for selection of samples. At first, on the basis of highest area and production of cultivation of paddy four districts namely Ganjam, Kalahandi, Bargarh and Mayurbhanj were selected from the four Physiographic zones of Odisha. Secondly, in each selected district, two blocks were selected randomly. Thirdly, from each block two villages were selected randomly. From each village 20 numbers of farmers were selected at random in the ratio of 2:2:1 (marginal, small and large). Thus a total of 320 farmers were selected for the present study. Probit model is used to identify the various socio-economic and farm characteristics influencing the farmer's decision to take part in the market (Egbetokun and Omonona,2012).

Yi = f (Xi, Di)……....(1)

Where,

Yi = Market participation decision by a household

Xi = Continuous factors of market participation decision

Di = Qualitative factors of market participation decision (dummy)

In this study the market participation decision is estimated as Y = 1 if the household participates in output markets and Y = 0 otherwise.

Market Participation= Total value of crop sale /Total value of crop production

Given the nature of market participation level, the farmers are said to be market participant if their proportion of value sold is more than 75% (Goletti, 2005; Ohen *et al*., 2013). Thus, it can be stated that the binary response variable as Y = 1 if the farmer's crop sales exceed a threshold or critical level of Y*(75%) and Y = 0 if Y ≤ Y*. The proportion of crop sold (say, above 75%) out of the total production in the production year can be used as the proxy of market participation during data collection period (Moyo, 2010).

Socioeconomic characteristics such as age, education, farm size, ownership of some assets and output were observed to have positive effect on market participation of various agricultural commodities (Olwande, Mathenge, 2012; Omiti *et al*., 2009; Randela *et al*., 2008). Following these studies, age, sex, education, farm size, household labor, non-farm income earning activates, access to credit, market information, value of produced crops, income from livestock, and non-farm income are used in Probit model as independent variables. Thus, the Probit regression model for identifying the factors that affect market participation decision of is framed in the following way:

$$\mathbf{Yi = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + ui \ldots\ldots\ldots\ldots (2)}$$

Where,

Yi refers to market participation decision by a household (Y=1, if farmers participate in the market, otherwise Y=0);

X1, X2,…....., X11 are explanatory variables that affect the market participation decision;

β0,……,β11 are parameters to be estimated; and ui is the stochastic disturbance term.

The Probit regression model adds the condition of normally distributed variables that can be formulated as:

Where, $Ii = \beta_0 + \beta_1X_1 + \ldots\ldots\ldots\ldots + \beta_{11}X_{11}$ = utility index (latent variable);

P(Y=1/X) = the probability of market participation;

Z = the standard normal variable, and

F = the standard normal CDF

RESULTS AND DISCUSSION

Table 1: Probit analysis for the decision of market participation by the farmers of Ganjam district

Variables	Coefficient	Std.Err.	Z-value	P >|z|
Sex	0.78	1.38	0.66	0.542
Age	-0.05	0.03	-0.61	0.523
Level of education	1.06***	0.07	-0.51	0.604
Farm size	0.70***	0.21	3.37	0.002
Household labour	-0.06	0.50	2.17	0.040
Non-farm activities	-0.55	0.60	-0.90	0.367
Use of credit	-0.37	0.60	-0.57	0.565
Market information	-0.80	0.63	-0.63	0.535
Non-farm income	-0.0000069	0.0000087	-0.75	0.534
Farm income	0.0000058*	0.0000073	1.78	0.079
Constant	-5.89	2.43	-1.74	
Log likelihood= -28.098735 LR chi2(11) = 83.03 Prob.>chi2= 0.0000 Pseudo R2= 0.67970				

Note: *, ** and * indicates 1%, 5% and10% level of significance respectively.**

Table 2:Marginal effects of the explanatory variables used to estimate probit regression

Variables	dy/dx	Std.Err.	Z-value	P >|z|	x-bar
Sex	0.082	0.04	0.34	0.542	0.78
Age	-0.001	0.01	-0.51	0.523	36.05
Level of education	0.258***	0.02	-0.62	0.604	4.50
Farm size	0.168***	0.03	2.38	0.001	3.09
Household labour	-0.007	0.09	3.13	0.040	2.19
Non-farm activities	-0.107	0.17	-0.81	0.361	0.31
Use of credit	-0.061	0.10	-0.47	0.567	0.89
Market information	-0.080	0.13	-0.83	0.531	0.43
Non-farm income	-0.000001	0.0000011	-0.93	0.534	31986
Farm income	-0.000001*	0.0000009	1.66	0.078	15673
Observed probability	0.3				
Predicted probability	0.1066888 (at x-bar)				
Log likelihood= -21.072235 Number of obs.= 100 LR chi2(11)= 80.03 Prob.>chi2= 0.0000 Pseudo R2= 0.6750					

Note: *, ** and * indicates 1%, 5% and 10% level of significance respectively.**

The result of probit analysis is presented in the Table 1. From the table, it can be seen that the likelihood ratio statistics as indicated by chi-square statistics are highly significant (P <0.0000), which suggests that the model has a strong explanatory power. The Pseudo R2 is 0.6750 indicates that the specification fits the data well and the variables incorporated in the model explain 67% of the variation in the output variable. It also indicates that the estimated coefficients of the Probit regression shows that the explanatory variables– 'farm size', 'level of education' and 'farm income' positively and significantly influence the farmers' decision to participate.

The Probit estimation result in Table 1 reveals that the variable 'farm size' is statistically significant at 1% level and has positive influence on the decision for market participation of households. This means that as the farm size increases, the probability of decision for commercialization increases. This could be due to the role of farm size in boosting total production level and thus sales of surplus produce.

The Probit results show that 'level of education' has a positive effect, on the decision of households to participate in the output market. The positive relationship indicates that the increased education level of the household enables access to more information and new opportunities in various markets. This means that the education level of household head is very important in enhancing market participation rate.

The table further shows that 'farm income' is another important variable having significant positive impact on the decision to participate in the output market. It is statistically significant at 10%.

In Table 2, the marginal effects of each variable on the predicted probability of households' market participation are tabulated. The marginal effects results of the Probit regression provides the probability that a farm household will participate in output markets. The marginal effect report of the Probit regression indicates that there is a probability of 17% that a farmer participates in the output market if his farm size increases. The marginal effect shows that there is a probability of approximately 26% that a farmer participates in the output market if there is increased education level of the household.

Table 3:Probit analysis for the decision of market participation by the farmers of Kalahandi district

Variables	Coefficient	Std.Err.	Z-value	P >|z|
Sex	0.87	1.60	0.78	0.649
Age	-0.03	0.04	-0.91	0.623
Level of education	-0.05	0.08	-0.31	0.704
Farm size	0.70***	0.22	2.51	0.001
Household labour	1.08***	0.50	3.17	0.070
Non-farm activities	-0.56	0.60	-0.81	0.337
Use of credit	-0.34	0.60	-0.97	0.467
Market information	-0.42	0.63	-0.33	0.531
Non-farm income	-0.0000062	0.0000085	-0.74	0.634
Farm income	0.0000047*	0.0000073	1.68	0.068
Constant	-4.27	2.10	-1.98	

Log likelihood= -21.072235 LR chi2(11) = 80.03 Prob.>chi2= 0.0000 Pseudo R2= 0.6550				

Note: *, ** and * indicates 1%, 5% and10% level of significance respectively.**

Table 4: Marginal effects of the explanatory variables used to estimate probit regression

Variables	dy/dx	Std.Err.	Z-value	P >|z|	x-bar
Sex	0.092	0.07	0.64	0.649	0.98
Age	-0.003	0.01	-0.65	0.623	44.08
Level of education	-0.007	0.01	-0.53	0.704	5.40
Farm size	0.128***	0.05	3.31	0.001	4.07
Household labour	0.198**	0.09	2.17	0.070	1.17
Non-farm activities	-0.107	0.12	-0.91	0.337	0.58
Use of credit	-0.061	0.10	-0.57	0.467	0.43
Market information	-0.080	0.14	-0.63	0.531	0.66
Non-farm income	-0.000001	0.0000017	-0.73	0.634	37252
Farm income	-0.000001*	0.0000008	1.86	0.068	10411
Observed probability	0.3				
Predicted probability	0.1066888 (at x-bar)				
Log likelihood=-21.072235 Number of obs.= 100 LR chi2(11)= 80.03Prob.>chi2= 0.0000 Pseudo R2= 0.6550					

Note: *, ** and * indicates 1%, 5% and10% level of significance respectively.**

The result of probit analysis is presented in the Table 3. From the table, it can be seen that the likelihood ratio statistics as indicated by chi-square statistics are highly significant (P <0.0000). The Pseudo R2 is 0.6550 which explains 65% of the variation in the decision of market participation of farmers. It also indicates that the estimated coefficients of the Probit regression revealed that the variables– 'farm size', 'household labour' and 'farm income' positively and significantly influence the farmers' decision to participate in the market.

The Probit estimation result shows that the variable 'farm size' is statistically significant at 1% level and has positive influence on the decision for market participation of households. This indicates that with the increase in farm size, the probability of decision for commercialization increases.

The results further shows that 'household labour' has a positive effect, at a significance level of 1%, on the decision of households to participate in the output market. The sign of the coefficient is positive and it means that if a farm family has more active labour, its probability for taking decision of participating in the output market increases.

The table also shows that 'farm income' is another important variable having significantly positive impact on the decision of smallholder farmers to participate in the output market. It is statistically significant at 10% level. This means that farmers' decision on market entry is related to the amount of farm production.

In Table 4, the marginal effects of each variable are predicted. The marginal effects results provide the probability that a farm household will participate in output markets. The marginal effect report of the Probit regression indicates that there is a probability of 13% that a farmer participates in the output market if his farm size increases. The marginal effect shows that there is a probability of approximately 20% that a farmer participates in the output market if he manages to have a mean of one additional active household labour.

Table 5: Probit Analysis for the decision of market participation by the farmers ofBargarh district

Variables	Coefficient	Std.Err.	Z-value	P >|z|
Sex	0.65	1.38	0.64	0.342
Age	-0.07	0.03	-0.61	0.323
Level of education	1.03***	0.07	-0.51	0.404
Farm size	0.98***	0.29	3.31	0.001
Household labour	-0.06	0.65	2.17	0.050
Non-farm activities	-0.49	0.69	-0.41	0.471
Use of credit	-0.78	0.60	-0.57	0.467
Market information	-0.88	0.43	-0.83	0.631
Non-farm income	-0.0000090	0.0000084	-0.53	0.334

Farm income	0.0000076*	0.0000073	1.38	0.071
Constant	-5.56	3.40	-1.68	
Log likelihood= -28.098735 LR chi2(11) = 83.03 Prob.>chi2= 0.0000 Pseudo R2= 0.69970				

Note: *, ** and * indicates 1%, 5% and10% level of significance respectively.**

Table 6: Marginal effects of the explanatory variables used to estimate probit regression

Variables	dy/dx	Std.Err.	Z-value	P >|z|	x-bar
Sex	0.092	0.07	0.65	0.342	0.98
Age	-0.003	0.01	-0.61	0.323	44.07
Level of education	-0.197***	0.01	-0.52	0.404	5.45
Farm size	0.138***	0.05	3.32	0.001	4.06
Household labour	0.198	0.08	2.18	0.050	1.17
Non-farm activities	-0.107	0.14	-0.92	0.471	0.58
Use of credit	-0.061	0.10	-0.58	0.467	0.47
Market information	-0.080	0.16	-0.63	0.631	0.66
Non-farm income	-0.000001	0.0000016	-0.73	0.334	37252
Farm income	-0.000001*	0.0000008	1.76	0.071	10411
Observed probability	0.3				
Predicted probability	0.1066888 (at x-bar)				
Log likelihood= -21.072235 Number of obs.= 100 LR chi2(11)= 80.03 Prob.>chi2= 0.0000 Pseudo R2= 0.6950					

Note: *, ** and * indicates 1%, 5% and10% level of significance respectively.**

The result of probit analysis is presented in the Table 5. From the table, it can be seen that the likelihood ratio statistics are highly significant (P <0.0000), suggesting the model has a strong explanatory power. The Pseudo R2 is 0.6950 which explains 69% of the variation in the decision of market participation of farmers. It also indicates that the estimated coefficients of the Probit regression revealed that the explanatory variables– 'farm size', 'level of income' and 'farm income' significantly influence the farmers' decision to participate in the market.

In Table 6, the marginal effects of each variable are reported in table. The marginal effect report of the Probit regression indicates that there is a probability of 14% that a farmer participates in the output market if his farm size increases.

Table 7: Probit Analysis for the decision of market participation by the farmers of Mayurbhanj district

Variables	Coefficient	Std.Err.	Z-value	P >|z|
Sex	0.73	1.80	0.70	0.540
Age	-0.02	0.03	-0.61	0.523
Level of education	-0.07	0.07	-0.51	0.605
Farm size	0.50***	0.21	3.31	0.001
Household labour	1.03***	0.50	2.17	0.040
Non-farm activities	-0.59	0.60	-0.91	0.361
Use of credit	-0.34	0.60	-0.57	0.567
Market information	-0.76	0.63	-0.62	0.533
Non-farm income	-0.0000067	0.0000083	-0.74	0.534
Farm income	0.0000089*	0.0000073	1.78	0.077
Constant	-4.36	2.40	-1.77	
Log likelihood= -27.072235 LR chi2(11) = 77.03 Prob.>chi2= 0.0000 Pseudo R2= 0.5850				

Note: *, ** and * indicates 1%, 5% and10% level of significance respectively.**

Table 8: Marginal Effects of the Explanatory Variables Used to Estimate Probit Regression

Variables	dy/dx	Std.Err.	Z-value	P >|z|	x-bar
Sex	0.092	0.07	0.64	0.540	0.98
Age	-0.003	0.01	-0.61	0.523	44.07
Level of education	-0.007	0.01	-0.52	0.604	5.40
Farm size	0.158***	0.05	3.31	0.001	4.07
Household labour	0.258**	0.09	2.17	0.040	1.17
Non-farm activities	-0.107	0.12	-0.91	0.461	0.58
Use of credit	-0.061	0.10	-0.57	0.567	0.43
Market information	-0.080	0.14	-0.63	0.531	0.66
Non-farm income	-0.000002	0.0000014	-0.73	0.534	37252
Farm income	-0.000001*	0.0000007	1.77	0.078	10411
Observed probability	0.3				
Predicted probability	0.1066888 (at x-bar)				
Log likelihood= -21.072235 Number of obs.= 100					
LR chi2(11)= 80.03 Prob.>chi2= 0.0000 Pseudo R2= 0.5850					

Note: *, ** and * indicates 1%, 5% and10% level of significance respectively.**

From the table 7, it can be observed that the likelihood ratio statistics as indicated by chi-square statistics are highly significant (P <0.0000), suggesting the model has a strong explanatory power. The Pseudo R2 is 0.5850 explains 58% of the variation in the decision of market participation of farmers. It indicates that the estimated coefficients revealed that the explanatory variables– 'farm size', 'household labour' and 'farm income' positively and significantly influence the farmers' decision to participate in the market.

In Table 8, the marginal effects of each variable are shown. The marginal effect report of the Probit regression indicates that there is a probability of 15% that a farmer participates in the output market if his farm size increases. The marginal effect further reveals that there is a probability of approximately 25% that a farmer participates in the output market.

CONCLUSION

From probit analysis we can conclude that the explanatory variables- 'level of income', 'household labour', 'farm size' and 'farm income' have positive and significance influence on the farmers decision to participate in the market with crop sale. As farm size increases the probability of decision for market participation increases. Results of marginal effects obtained from probit regression indicate that the probability that a farm household will participate in output markets. In Ganjam district the marginal effect report of the probit regression indicates that there is a probability of 16% that a farmer participates in the output market if his farm size increases. The marginal effect reveals that there is a probability of approximately 25% market participation in the output market if there is increase in education level of the household heads enables access to more information and new opportunities in various markets for their product. In Kalahandi district the marginal effect results shows that there is a probability of 13% that a farmer participates in the output market if his farm size increases. In Bargarh district the results of marginal effects shows that there is a probability of 14% that a farmer participates in the output market if his farm size increases. In Mayurbhanj district the marginal effect report of the probit regression indicates that there is a probability of 15% that a farmer participates in the output market if his farm size increases. The marginal effects results shows that there is a probability of approximately 25% that a paddy farmer participates in the output market if he manages to have a mean of one additional active household labour.

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