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Determinants of Participation Behavior of Limited Resource Farmers in Conservation Reserve Program in Alabama

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Abstract

This study investigated factors that affect participation behavior of limited resource farmers (LRF) in Conservation Reserve Program (CRP) in Alabama**.** A binary logit model was employed to analyze data obtained from 611 respondents. Results indicated that males, part-time occupation, total acres, participation in non-conservation related programs, direct method of receiving CRP information, and respondents' interest in receiving CRP information, were strong predictors of participation in the CRP.

Key words: Limited resource, CRP, minorities, participation behavior

Introduction

The conservation reserve program (CRP) is one of the most effective and popular federal soil conservation programs on private lands. The CRP is a land-retirement program in which farmers keep their land from agricultural practices and implement conservation practices. Participation in the CRP is voluntary requiring landowners to sign a contract with the government and in turn they receive government incentives to implement a conservation plan. The plan will help to manage less productive land by diverting farmers' efforts for growing high valued commercial crops on productive farmland. The participants are given rental and cost-share payments to cover the cost of establishing a permanent land cover on such land.

The program has resulted in the reduction of soil loss on these acres. In Alabama, for instance, CRP resulted in the reduction of soil loss from 10,696,039 tons per year to 686,980 tons per year on the enrolled acres from the initial sign-ups (Onianwa & Wheelock, 1995). Economic benefit from this program is estimated to be $8 billion or more per year (NRCS Report, 2000). Since 1985, a total of 484,129 acres have been diverted to conservation practices and in 2000, 967 contracts were signed up for CRP on 39, 713 acres of land in Alabama (NRCS Report, 2000).

McLean-Meyinsse et. al. (1994), Desmukes (1997), Onianwa et al. (1999), and Molnar et al. (2000) have reported that participation of LRFs who own marginal, degraded, and erosion prone lands have been low compared to larger farmers in government sponsored programs. The objective of this paper was to investigate the determinants of CRP participation among limited resource farmers in Alabama. An understanding of the distinguishing factors that differentiate participation behavior of participants and non-participants will assist in improving CRP participation in Alabama in particular and the nation in general.

Literature Review

Many studies have assessed participation behavior of agricultural farmers or landowners in government sponsored programs. Ervin and Ervin (1982) simulated a conceptual framework to analyze the decision- making behavior of farmers in conservation practices. The study suggested that amount of cost-sharing was a major component that affected participation behavior. Also, younger farmers appeared to be more receptive to a wider range of conservation practices due to higher education and better understanding of erosion problems. In a similar study in two Virginia counties, Norris and Batie (1987) found that well understanding of erosion problem, higher incomes, larger farm sizes, and lower debt levels were associated with higher number of conservation practices. The authors suggested for more flexibility in the eligibility criteria to include larger segment of small farmers in conservation programs.

Reichelderfer and Boggess (1988) revealed that farmers compare benefits of other non-cost-share programs with the CRP before bidding the CRP. In the assessment of the relationship between farm structure and the CRP in the 1985 Farm Bill, Kairumba

and Wheelock (1990) found that gross income and crop acres were highly significant in predicting participation behavior in the CRP. Similarly, McLean-Meyinsse et. al. (1994) in a study of Louisiana small farmers' participation in the CRP indicated that farmers did not enroll their land to the CRP because they thought that they would loose revenues from their existing croplands if they participate in the CRP. Likewise, the same study suggested that race, age, farm status, education, income, and farm revenue affect positively on willingness to participate in the CRP. The result of the study by Nagubedi et al. (1996) on non-industrial private forest landowner's participation in cost-share programs in Indiana suggested that cost-share program participants found government sources of written information more important than other sources of information.

Onianwa et al. (1999) in a study of factors affecting conservation practice behavior of CRP participants in Alabama revealed that gender, education, farm size, ratio of cropland in the CRP, prior crop practice, and geographic location of contract holders significantly influenced farmers' choices of conservation practices. In a study of conservation practices adopted by small and limited resource farmers of Georgia, Mississippi, and Alabama, Molnar et al. (2000) found that the CRP was the most often used cost-share program by farmers in the three states. The study found that white farmers' participation were higher than that of African American farmers. The study reported the highest African American-white difference for Alabama (33 percent) and the least for Georgia (7 percent).

Economic theory provided limited guidance in the selection of variables in explaining the participation behavior of farmers (Norris and Batie, 1987). Many past studies have understood difficulty of developing a conceptual model that best explains

participation behavior (Bell, et al., 1994). However, a commonality of past studies is the significant recognition of demographic and socioeconomic factors to explain participation in conservation programs. Gender, race, age, education, occupation, income, land acres, and information channel were common to most of the studies. The questionnaire for this study sought information on the variables that were mostly used by the past studies.

Data Description

Mail questionnaire was sent to 2,555 samples selected randomly from the 1997 database of 25,403 LRFs maintained by National Agricultural Statistics Service (NASS), Montgomery, Alabama. LRFs in this study were defined as the farmers who earn equal or less than $40,000 gross value of sales in a year through agricultural sales. To ensure adequate representation of both white and minority farmers, the samples were stratified by race. The entire minority LRFs of 1,340 reported in NASS database were included in the sample. Only five percent (1,215) of white LRFs were randomly selected resulting in a total of 2,555 white and minority farmers for the study.

Altogether, a total of 800 responses were obtained; 352 minority farmers and 448 white farmers, yielding a response rate of 26 percent for minority and 37 percent for whites. However, 189 surveys out of 800 were considered unusable as they lacked required information for the CRP. Consequently, the remaining 611 surveys were tabulated for the final analysis. The survey showed that 107 (17.51%) respondents participated in the CRP. This study was based on these 107 CRP participants.

Theoretical Model

Past studies investigated participation behavior as a dichotomous variable by classifying it as a binary participation or not participation group (Bell et, al., 1994; Nagubedi, et al., 1996). In this study, the participation behavior was defined as farm operators' participation in the CRP (Nagubedi, et al., 1996). By assessing the characteristics (such as gender, race, age, education, occupation, acres, etc.) of participants and non- participants, the probability of participation or non-participation in the CRP can be estimated (Bell et. al, 1994).

The logit model was employed to examine the relationship between participation behavior and explanatory variables. This model is useful for situations in which the prediction of the presence or absence of an outcome is needed based on values of a set of explanatory variables (SPSS, 1999). When the dependent variable has two values, the assumptions of ordinary least squares are violated. For instance, in the presence of categorical dependent variable, the least square function is nonlinear in β_0 and β_i, and error variance is not normally distributed, and the predicted values cannot be interpreted as probabilities (Hosmer & Lemeshow, 2000; SPSS, 1999). However, the binary logistic model is appropriate and performs well in this situation (Davidson & McKinnon, 1993; Gujrati, 1995; Quinn & Keough, 2002). Logistic regression coefficients can be used to estimate the contribution of each explanatory characteristic to the participation behavior of LRFs in the CRP.

A binary dependent variable defined as $Y_i = 1$ if a LRF has participated in the CRP, and $Y_i = 0$ if a LRF has not participated in the CRP was specified. The vector of Y_i

was assumed to depend on a personal utility function, which is determined by a vector of independent variables (X_i) (McLean-Meyinsse, 1994). The logistic regression model below states that the log of the odds equals the constant (β_0) plus the product of the estimated coefficients β_i and X_i.

$$P_i = E(Y = 1 \mid X_i) = b_0 + \Sigma b_i \ X_i$$

$$L_i = 1n\left(\frac{P_i}{1 - P_i}\right) = Z_i = b_0 + \Sigma b_i X_i$$

Where, L was the natural log of the odds of participation in CRP, also called the logit. β_0 is a constant and β_i is the logistic coefficient that can be interpreted as the change in the log odds associated with a one-unit change in the independent variable . This coefficient was used to estimate the probability of participation (P_i) and non-participation ($1-P_i$). The change in probability was calculated as follows (Bell et al., 1993).

$$\Delta P_i = b_i P_i (1 - P_i)$$

Where P_i is the estimated probability of participation at each observation; and β_i is the estimated coefficient. The change in a probability (ΔP_i), therefore, is a function of the probability of participation (P_i) multiplied by the probability of not participating in the CRP ($1-P_i$) and the estimated coefficient (β_i) considering other variables constant.

Variables used in the Analysis

Table 1 shows the 12 independent variables that were used in the logit analysis their definition, and the hypothesized relationship. The variables were GENDER with male '1', and female '0'; RACE with minority '1' and white = 0; EDUCATION with 1 if

education level is college graduate or greater and 0 if less than college graduate. The occupation was represented by two dummy variables: FULLTIME with 1 if LRF is a full time farmer or 0 for otherwise and PARTTIME with 1 if a LRF is a part-time farmer or 0 for others. The PARTICIPATION IN OTHER PROGRAM variable with 1 indicates participants in other non-cost-share government programs (such as livestock/feed assistance, farm production, etc) and 0 for non-participants. The DIRECT CONTACT variable represents LRF preferred source of receiving information: 1 if a LRF prefers direct method of receiving cost-share information (such as personal visits, seminars, etc) and 0 for otherwise (correspondence, printed materials, media). The INTEREST variable with 1 indicates if a LRF is interested in receiving cost-share program information and 0 for otherwise. In addition, INCOME SOURCE variable indicates percentage share in household income: 1 if the source of household income is farming, and 0 for other sources. The other variables are AGE, which is LRF's age in years, and TOTAL ACRES is the total operated acres (owned plus rented). In addition, an interaction variable was created for minority-owned acres to represent the effect of minority owned acres on the CRP participation.

Table 1. Independent Variables used in the Logistic Analysis

Independent Variables	Variable type	Variable Name	Expected Relationship with the CRP participation.
GENDER	Dummy	1 = male 0 = female	+ve
RACE	Dummy	1 = Minorities 0 = Whites	-ve
EDUCATION	Dummy	1 = College graduates 0 = < college education	+ve
AGE	Continuous	Actual age	+ve
FULLTIME	Dummy	1 = Fulltime Farmers 0 = all others	-ve
PARTTIME	Dummy	1 = Part-time farmers 0 = all others.	+ve
TOTAL ACRES	Continuous	Actual acreage owned	+ve
MINORITY-OWNED ACRES (INTERACTION)	Continuous	Actual acres owned by minority groups	+ve
INCOME SOURCE (PERCENT)	Continuous	Percent share of income from farming on total household income	?
PARTICIPATION IN OTHER PROGRAM	Dummy	1 = Participated in other gov. Programs 0 = not participated	+ve
DIRECT CONTACT	Dummy	1= LRF prefers direct contact as the preferred method for cost-share program information 0 = all other methods	+ve
INTEREST IN RECEIVING INFORMATION	Dummy	1 = LRF not interested in receiving information on cost-share programs 0 = if LRF is interested	-ve

Results

      The logit analysis correctly predicted 519 cases (28 participants and 491 non-participants). Overall, 85 percent of the total cases (611) were correctly classified. The likelihood ratio test was highly significant with a score of 125.0 suggesting that there was a relationship between the probability of LRFs choosing to participate and the explanatory variables.

      Table 2 shows the result of binary logit analysis and the change in probability for the parameters. The change in probability gives the percentage change in probability of occurrence (participation) when multiplied by 100 given a change in an independent variable, *ceteris paribus* (Bell et al., 1994). In the table, the wald statistics with corresponding significance level (p-value) indicated that males, part-time farmers, total acres, participation in other program, direct contact, and no interest in receiving information, were significant with participation in the CRP at the five percent level. In addition, minority, college graduates, income from farming, and minority owned acres were significant with participation in the CRP at the 10 percent level.

      The estimated coefficient (β) shows a negative coefficient for gender indicating that males were less likely to participate in CRP compared to females. The change in probability indicates that for a unit change in number of males, there was a 0.036 unit change in the probability of participation in the CRP considering other variables constant. In other words, for a change in female to male numbers, there was a 3.6 percent decrease in the probability of participation in the CRP. The logit result for a race variable indicates that minorities are less likely to participate in CRP. In this case, for a unit change from whites

to minority LRFs, there was a 4.3 percent decrease in the probability of participation in the

CRP.

Table 2. Probability Estimation of the Logistic Model

Variables	b Coeff.	Stand. Error	Wald Statistics	Sig. Level	Change in Probability
Constant	-2.274	.762	8.915	.003	
Males**	-.722	.326	4.909	.027	-.036
Minorities*	-.636	.369	2.980	.084	-.043
College Graduates*	.394	.262	2.266	.102	.037
Age	.017	.011	2.477	.116	.003
Full-time	-.747	. .547	1.862	.172	-.060
Part-time **	-.630	.274	5.290	.021	-.043
Total acres**	.005	.001	25.319	.000	.0006
Minority-owned Acres*	. 003	.002	2.936	.087	.00028
Income from Farming*	-.017	.010	3.230	.072	-.0012
Participation in non-cost-share gov. programs**	-.766	.371	4.260	.039	-.058
Direct Contact**	.892	.264	11.410	.001	.0939
No interest on receiving information**	-1.606	.472	11.573	.001	-.102

** Significant at 5% level
* Significant at 10% level

In the case of education, there was a 3.7 percent increase in the probability of

participation in CRP for a change from below college education to college education. The

table also shows that part-time occupation was a significant predictor of participation in

CRP but it had negative sign, which was not expected. In this case, for each unit increase

in the number of part-time farmers, there was about 4.3 percent decrease in the

participation in CRP. Similarly, the larger the acres of land owned, the higher the

likelihood of participation in the CRP. The total acres had the expected sign. For a unit

increase in the total acres, there would be .006 percent increase in the probability of participation in CRP. Similarly, for the effect of minority-owned acres, the result was positively significant.

Also, the income from farming has significant but negative effect on the participation in CRP. In this case, one percent increase in farm income would result in .12 percent decrease in participation in CRP. Likewise, a negative but significant effect was occurred in the CRP participation due to the participation in other non cost-share government programs. In this case, the result indicated that for a unit increase in the number of participants in other non-cost share government programs, there would be a 5.8 percent decrease in the probability of participation in the CRP.

The 'direct' method of information sources for cost-share program information has positive and significant effect on the participation in CRP. In this case, for a change in the cost-share information method from indirect contact to direct contact method, there was a 9.3% increase in the probability of participation in CRP. However, in the case of the effect of no interest of the respondents in receiving information, the result showed negative but significant effect on the participation in the CRP. In this case, for a unit increase in the numbers of 'no interest in receiving information farmers', the result indicated a 10.2 % decrease in the probability of participation in CRP.

Although, the logit result suggested no significant relationship of age and full-time occupation with the participation in the CRP, the result produced the expected signs for those two variables.

Conclusion

The objective of this study was to investigate factors that affect participation of LRFs in the CRP. Specifically, the study identified the characteristics that differentiated between LRFs that participated in the CRP and those who did not. The results suggested that the likelihood of a LRF participating in CRP is influenced by gender, race, part-time occupation, size of acres owned, and income from farming. In addition, the participation in CRP is affected by the participation of LRFs in other non-costshare government programs, methods of providing cost-share information to LRFs, and LRF's interest in receiving cost-share programs information.

The findings suggest that males and minorities are less likely to participate in CRP compared to females and whites, respectively. The LRFs with higher acres of land seem to have a greater probability of participation. As the acre increases, the participation in cost-share programs also increases indicating that larger acre owners are more likely to participate in CRP. On the other hand, participation of LRFs who receive higher percentage share of household income from farming is low. These farmers may be subsistence farmers who own small acres of land. For these farmers, farm income is more important compared to the CRP benefits, therefore they intend not to keep their farm from agriculture.

On the other hand, the study suggested that age and full-time occupation had no significant relationship with the participation in CRP. Eventhough, age and full-time occupation were not significant, the result produced the expected signs, which is consistent with the previous studies.

The results of this study suggested that gender, farm size, part-time occupation, method of receiving information, interest in receiving information, and participation in other government programs were strong determinants of the participation behavior of LRFs in CRP. The study recommends that the CRP participation of LRFs can be improved by focusing government outreach efforts on minorities, small owners, and less educated farmers.

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