Factors Affecting Participation Behavior of Limited Resource Farmers in Cost-Share Programs in Alabama

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ABSTRACT

This study examines factors that affect the participation behavior of limited resource farmers in cost-share programs in Alabama. The data was generated from a survey administered to a sample of limited resource farm operators. A binary logit was employed to analyze the data. Results indicate that college education, age, total farm size, as well as membership in conservation association had significant influence on participation.

Key Words: *limited resource farmers, participation behavior, binary logit, cost-share.*

Introduction

Evidence indicates a low participation in government conservation and forest management practices among farmers in general and limited resource or small farmers in particular. Bell et al. observed a chronically low participation in incentive-based forestry programs and CRP in Tennessee even-though these programs enjoy the added incentive of an annual rental payment. Also, McLean-Meyinsse, Hui, and Joseph, Dismukes, Harwood, and Bentley, and Molnar, Bitto, Brant and Hoban, have all noted lower participation in government-sponsored programs among small and limited resource farmers. This disparity may be partially due to the small average size of qualified acres, lower average crop yields, and higher likelihood of not planting program crops, as well as less sophisticated technology, insufficient collateral, poor cash flow, and poor credit ratings (GAO, 1997).

Conservation and forest management practices are designed to increase reforestation, improve timber stands, increase wildlife habitat, reduce soil erosion and, protect water quality and the environment. They are generally voluntary with some incentives provided to participants to encourage their participation (USDA). The incentives stem from financial compensation like tax rebates and cost sharing in some cases, to non-financial assistance such as technical guidance and provision of seedlings in other cases (Nagubadi et al.). With regard to cost-share programs, they are designed to provide incentives to agricultural producers to implement soil and water conservation practices (Zinn). Specifically, cost-share programs assist land owners by partially paying for the expenses of installing conservation practices such as site preparation and seeding, tree planting, recreational improvements and, design of resource management plans and

erosion control measures. Some examples of cost-share programs or programs with cost share elements are the Emergency Conservation Program (ECP), the Conservation Reserve Program (CRP), the Forest Incentives Program (FIP), the Wetland Reserve Program (WRP), the Forest Service Stewardship Incentives Program (FSSIP), and the Farmland Protection Program (FPP) (Zinn; Nagubadi, et al.).

The conservation reserve program remains the most popular among the cost-share programs in Alabama, with over 10,000 contracts and approximately 484,129 acres enrolled prior to year 2000, additional 967 contracts on 39,713 acres were signed on, in 2000 (NRCS Report). Initiated in 1985 with the objective of reducing soil erosion on highly erodible cropland, CRP provides cost-share money to establish the required conservation plan and rental payment to farmers. In return, farmers are required to withdraw land from crop production and to plant permanent tree or grass coverage for a full contract period of 10-15 years.

Several studies have been conducted to examine the factors that affect participation in government-sponsored programs. While the results could be generalized for policy purposes in some cases, they have not been consistent across the states. For instance, in a study of Forest Stewardship Incentive Program in Tennessee, Bell et al. found farmers' attitude towards conservation and knowledge of forestry to be more significant indicators of participation than monetary incentive. In contrast, Norris and Batie in a study of soil conservation decisions in Virginia concluded that financial factors as well as other socioeconomic factors were the influential variables. Therefore, the variables of importance may differ depending on the state and the program. This suggests the need and importance to study the participation behavior in other states or regions.

Furthermore, while participation behavior in cost-share programs has been examined in several states, no study has been done to evaluate the behavior of Alabama farmers. This study will attempt to fill this void and further contribute to the existing literature on participation in government sponsored-programs.

The objective of this study was to evaluate factors that affect limited resource farmers' (LRFs) participation in cost-share programs in Alabama. Following Molnar et al., the term limited resource farmers in this study refers to farmers with annual gross farm sales of less than or equal to $40,000. The next section provides a review of the relevant literatures. This is followed by a discussion of the data description, the theoretical framework and empirical model employed. The results are then presented followed by a summary of conclusions and policy implications.

Review of Literature

This research effort was motivated by a need to understand the distinguishing characteristics of participants in cost-share programs. Participation behavior in government-sponsored programs has been extensively addressed. This section attempts to identify and summarize key variables used in previous studies. According to Ervin and Ervin, literature on factors affecting adoption practices and use of soil conservation practices began to emerge in 1950. However, there is limited guidance for the selection of variables to explain the resource conservation actions of farmers from economic theory. However, Prundeaner and Zwerman noted in 1958 that while there may be the same level of hazard between farms, producers differ in implementation of soil conservation schemes due to different socioeconomic environments. Bell et al. examined the likely

effect of cost-share incentives on participation in the Tennessee Forest Stewardship Program and identified other factors that contribute to participation using a random utility model. Their results indicate that attitudes and knowledge of forestry programs may be more influential in a landowner's decision to participate than monetary incentives. Norris and Batie analyzed farmers' soil conservation decisions using data from a survey of farm operators in two Virginia counties. They concluded that financial factors (income and debt), perception of erosion, educational level, off-farm employment, and tenancy were important influences on the sample farmers' use of conservation practices. In addition, age, race, and on-farm erosion potential were significantly related to the use of conservation tillage. Similarly, in a study of conservation practice choice of CRP farmers in Alabama, Onianwa, Wheelock, and Hendrix analyzed 594 randomly selected Conservation Reserve Program contracts and found education, ratio of cropland in CRP, farm size, gender, prior crop practice, and geographic location of contract to have significant influence on the choice of conservation practice adopted. Nagubadi et al. in a study of program participation behavior of non-industrial forest landowners in Indiana found total land owned, commercial reasons for ownership, government sources of information, and membership in forestry organizations to significantly influence landowners' program participation. Other significant factors include: age, fear of loss of property rights, and duration since the first wooded tract was acquired. However, with regard to cost-share programs, location of residence on wooded land, knowledge of and willingness to participate in a conservation easement influenced participation. Also, Kalaitzandonakes and Monson investigated the influence of economic, personal, and attitudinal factors on intended conservation effort of a sample of conservation reserve

program contract holders in Missouri at the end of their contracts and found that economic factors such as greater risk aversion and low discount rates had positive and significant effect on potential conservation effort, while increasing debt load was found to have a negative influence on potential conservation effort. However, attitudes towards conservation were found to have no significant influence on potential conservation effort. Finally, Lynn, Shonkwiler, and Rola, using an extension of the tobit model examined attitudes and farmer conservation behavior of Florida farmers. The results indicated that strengthening conservation attitudes would reduce the need for dependence on technical assistance and other net income-enhancing programs. They concluded that although economic incentives will increase effort, responsiveness would differ with the strengthening of conservation related attitudes. These aforementioned studies provide a basis for selecting variables to empirically examine the program participation behavior of limited resource farmers in this study.

Data Description

The data for this study was generated through a mail survey. The survey was designed to solicit pertinent information to facilitate the study. Information relating to the socioeconomic characteristics of the respondents and their participation in cost-share programs were requested. The mail survey was administered through the National Agricultural Statistics Service (NASS) office in Montgomery, Alabama. The 1997 Census of Agriculture of more than 41,000 Alabama farmers maintained by the NASS and stratified for limited resource farmers served as the population for the study. These strata consisted of 1,340 minority farm operators and over 24 thousand white farm

operators reporting less than $40 thousand in cash receipts. From this population, five percent (1,215) of the white farm operators were randomly selected, while all the minority operators were included to ensure adequate representation of both groups. The survey was pre-tested and modified accordingly prior to mailing. A total of 217 minority farm operators and 233 white farm operators completed and returned the surveys from the first round of mailing. To boost the response, a follow-up survey was mailed to non-respondents. This effort resulted in additional 135 minority responses and 215 white responses, yielding a combined total of 800 respondents. However, 77 surveys were excluded from the analysis due to incomplete information. The remaining 723 surveys comprising 313 minority farmers and 410 white farmers were tabulated for the final analysis.

Theoretical Framework and Empirical Model

Indirect Utility Function

A random utility model was used to determine the probability that a limited resource farmer will choose to participate in the cost-share program. Following Bell et al. the indirect utility function can be specified as a linear function with the individual subscript suppressed:

$$\psi_\iota = \beta_0 + \beta_1 D + \beta_2 Y + \beta_3 F + \beta_4 P + \beta_5 M + \beta_6 Z + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where ψ_ι is the indirect utility received by the individual from participating (ι=1) or not participating (ι=0) in the cost-share program; D is a vector of personal socioeconomic

characteristics that influence participation in participation; Y is income from all sources; F is the farm size; P is participation in other government programs; M is membership in any conservation organization; and Z is a vector of Alabama agricultural reporting districts as defined by the NASS. $\beta_{t\,s}$ are the parameters of the model with β_1 and β_6 each representing vectors of parameters.

The Logit Model

Following Gujarati, the probability of participating in cost-share program is given by:

$$P_t = E(Y = 1|X_i) = \Sigma_i \beta_i X_t \quad \text{.....(2)}$$

Where, P_t is the probability that Y equals 1 for given values of X for all $i = 0 \ldots n$ represents the explanatory variables; β_O represents the intercept, and β_i represents coefficients to be estimated.

Given the dichotomous nature of the data, logit model as originally suggested by Berkson and redefined by Theil was adopted to analyze the data. In cumulative logistic distribution, Equation 2 can be represented as:

$$P_t = E(Y = 1|X_i) = \frac{1}{1 + e^{-(\beta_0 + \Sigma\beta_i X_i)}} \quad \text{.....(3)}$$

Where, e is the base of the natural logarithm. For simplification, Equation 3 could be written as:

$$P_t = \frac{1}{1 + e^{-z_i}} \quad \text{.....(4)}$$

Where: Z_i is a linear combination ($\beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots + \beta_nX_n$) and ranges from $-\infty$ to $+\infty$, P_t ranges between 0 and 1. If P_t represents the probability of participating in cost-share programs, then ($1 - P_t$) represents the probability of not participating in cost-share programs so that;

$$1 - P_t = \frac{1}{1 + e^{z_i}} \quad \text{.....(5)}$$

Equations 4 and 5 could be combined as shown below:

$$\frac{P_t}{1 - P_t} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \quad \text{..... (6)}$$

$\frac{P_t}{1-P_t}$ is the odds ratio of participating in cost-share program, which is the ratio of the probability that limited resource farmers would participate to the probability that limited resource farmers would not participate in cost-share program. Taking the natural log of Equation 6 results in the following estimable equation:

$$L_i = 1n\left(\frac{P_t}{1 - P_t}\right) = Z_i = \beta_0 + \Sigma\beta_i X_i \quad (7)$$

Where:

L_i is the log of the odds of participation in cost-share programs called the logit and X_i are the independent variables. P_t is the conditional probability of a farmer participating in cost-share program given $X_{i,}$ and β_i are parameters to be estimated.

Variable Definitions

Dependent Variables

The dependent variable (PART) is a dichotomous variable of participating or not participating in cost-share programs. A value of "1" was assigned for those respondents who participated in at least one cost-share program and "0" was assigned for those who had not participated in any. Thirty percent of the respondents (219) participated in at least one cost-share program. Descriptive statistics of the dependent variable are presented in Table 1.

Independent Variables

The independent variables used in the logit model are also summarized with the descriptive statistics in Table 1. Twelve dummy variables were created to facilitate the analysis. A dummy variable was used to distinguish between male and female, and it was hypothesized that males will be less likely to participate in cost-share program than females. Race was also represented with a dummy variable with minority '1' and white "0". The minority consists of all non-white respondents. In this case, minorities were hypothesized to have a negative sign, suggesting that they were less likely to participate. Other dummy variables include: education, with college graduate '1' and less than college graduate '0', part-time farmers, membership in conservation organization, and participation in other non-cost-share government programs. Education, part-time farming,

participation in other non-cost-share government programs, and membership in any conservation association were all hypothesized to have a positive effect on participation in cost-share programs. Other variables in the model include age, which was a continuous variable, and total acre. They were both hypothesized to have positive effects on participation. An interaction term for minority-owned acres was added to distinguish the effect of minority-owned acres from white owned acres.

Furthermore, six dummy variables were created for the agricultural reporting districts following NASS classification to permit the examination of the regional impacts on cost-share administration (see figure). *DIST 1* and *DIST 2* represent the "Tennessee Valley," comprised of substantial real estate development (commercial, industrial, and residential) and premium cropland. Extending across the state, *DIST 3* is home to two national forests, Talladega and Bankhead, and is parallel to *DIST 4*. *DIST 4* is affectionately termed the "Black Belt," because of the dark soil color characterizing this region. *DIST 5* and *DIST 6*, located in the southwestern and southeastern parts of the state, respectively, are home to most of Alabama's privately owned pine forests. However, due to dummy variable loop, only five district dummies were included in the model.

Results

Two empirical models were estimated. The first one was without the district dummy variables, and the second one incorporated the district dummy variables. The estimated results of the first model are presented in Table 2. The maximum likelihood estimated coefficients, the Wald tests, the changes in probability, as well as the

likelihood-ratio test, the Nagelkerke R^2, and the prediction success statistics are presented. Measures of goodness of fit indicate that the model fits the data fairly well. The likelihood-ratio test, which measures the significance of the logit function, was highly significant with a score of 92.9, suggesting that there exists a relationship between the probability of a farmer choosing to participate and the suggested independent variables. Although the R^2 value is low, which is the norm in logistic regression (Hosmer and Lemeshow), the model correctly predicted 68.7 percent (497 out of 723) of the responses using a 30 percent participation rate. Correct predictions were relatively evenly distributed with 72.8 percent of non-participants (367 out of 504), and 59.4 percent of participants (130 out of 219) correctly predicted.

Following Bell et al. and, Pindyck and Rubinfeld, the estimated results were interpreted using the change in probability (ΔP_i) at the mean:

$$\Delta P_i = \beta_i \mathrm{P}_i(1 - P_i) \quad \text{.....(8)}$$

where P_i is the estimated probability of participation at each observation; and β_i is the estimated coefficient. The change in probability (ΔP_i) is a function of the probability and when multiplied by 100 gives the percentage change in the probability of the event occurring given a change in the variable, all things being equal.

The results indicate that education (college graduates), age, and total acres (owned and rented regardless of race) were positively significant with participation in cost-share program at the five percent level. This means that the probability of participation will be higher for limited resource farmers who are older, have higher

education, and more acres of land. The change in probability with regard to education suggests that college graduates were 4.3 percent more likely to participate in cost-share programs than farmers without a college degree. In the case of age, a unit increase in age will result in approximately 0.3 percent increase in participation, and a unit increase in total acres would result in a 0.04 percent increase in the probability of farmer participation. While the total acreage variable had a positive impact on participation, the minority acreage interaction term was not significantly greater as had been the case of total acres variable. Membership in conservation organization was also positively significant with participation in cost-share programs, although at the .075 level. Compared to nonmembers, membership in any conservation organization would increase the probability of participating in cost-share programs by 5.1 percent.

The variables: males, minorities, part-time farming, and participation in other non-cost-share conservation programs were not significant, although males, part-time farming, and participation in other non-cost-share conservation programs had the expected signs. Contrary to expectation, the minority variable had a positive but non-significant sign. This may be due to the fact that minority in this study includes all other non-white races. The interaction term, which was created to examine the effect of minority-owned acres on participation, exhibited a positive but non-significant relationship

Table 3 presents the estimated maximum likelihood coefficients, the Wald tests, the changes in probability, the likelihood-ratio test, the Nagelkerke R^2, and the prediction success statistics for the model with the agricultural reporting districts. Again, measures of goodness of fit indicate that the model fits the data fairly well. The likelihood-ratio test

was highly significant with a score of 95.5, suggesting that there was a relationship between the probability of a farmer choosing to participate and the suggested variables. The Nagelkerke R^2 in this case was .18 and the model correctly predicted 69.16 percent (500 out of 723) of the responses. Correct predictions were again relatively evenly distributed with 73 percent of non-participants (369 out of 504), and 60 percent of participants (131 out of 219) correctly predicted.

The results show that introduction of agricultural districts have little or no effect on the model. Again, education (college graduates), age, and total acres were positively significant with participation in cost-share program at the five percent level, suggesting that the probability of participation will be higher for limited resource farmers with higher education, large acres of land, and older in age, irrespective of the region. The change in probability with regard to education suggests that participants with college degrees were 3.4 percent more likely to participation in cost-share programs than those with no degrees. Also, a unit increase in age will result in approximately .3 percent increase in participation, while a unit increase in number of acres would result in a 0.04 percent increase in the probability of participating.

Again, membership in conservation organization was positively significant with participation in cost-share programs at the 10 percent level. Membership in conservation organization would result in 4.5 percent increase in the probability of participating in cost-share programs.

The variables: males, minorities, part-time farming, and participation in other non-cost-share conservation programs were not significant although males, part-time

farming, and participation in other conservation programs had the expected signs. Again, the minority variable and the minority-owned acres were positive but non-significant.

The effect of income on participation was also examined in both models using gross farm receipt as a proxy for income. However, the results were not significantly different from these results.

Summary and Conclusion

This research examined factors affecting participation in cost-share programs in Alabama. The results indicate that college education, age, and total acres owned were significant predictors of participation in cost-share programs. For example, the results from the first model showed that participants with college degrees have four percent higher probability of participating in cost-share program than those with no college degrees. Similarly, for each unit increase in the age of the farm operator or total acres there was approximately, 3 or .04 percent increases in participation, respectively. Furthermore, membership in conservation organization was a significant indicator of participation in cost-share programs. Limited resource farmers who were members in any conservation organization had about five percent higher probability of participating in cost-share programs. This is probably due to the fact that farmers that belong to conservation associations are more environmentally conscious and therefore much more likely to participate in conservation programs. This result is consistent with the findings of Nagubadi et al., which stated that membership in forestry organization was a significant influence on participation.

With the exception of race, all the remaining variables had the expected signs, although they were not significant. In contrast, minority participants had a positive but non-significant sign. This may be due to the differential effect of higher participation rates of minorities among members of conservation organizations.

The results of the second model with the agricultural districts were consistent with the first model, suggesting that regional differences had no effect on participation in cost-share programs. Again, college education, age, and total white-owned acres were positive and significantly related to participation in cost-share programs. Also, membership in conservation organization was positive but significant at the 10 percent level. There were no significant differences between the agricultural districts with regard to participation in cost-share programs as revealed by the results

From a policy perspective, the results of this study provide further insights into the characteristics of participants in cost-share programs. This information would assist in designing policies to enhance cost-share programs in particular and other government-sponsored programs in general. Zabawa, Madden and Tischbein, and DeWalt have all noted the importance of directing agricultural policy to specific clientele to be effective. Consequently, to enhance participation in cost-share programs, different strategies could be designed to target specific groups of farmers based on their educational background, age, size of farm, as well as whether or not they are affiliated to conservation organizations.

Membership in a conservation organization was a minimal nine percent of the sample, but was a significant predictor ($p=.075$) of participation in a cost share program. Regardless of race, cost-share program participation was greater among conservation

awareness organization members than among non-members. The results suggest that a more inclusive membership campaign by way of formal conservation organizations would significantly increase cost-share conservation program participation. This may be particularly true of minority farmers who may be out of the loop with regard to informal conservation groups. Therefore, government agencies may find collaborations with non-governmental conservation organizations an effective means through which farmer stewardship of land and water resources could be encouraged while reducing environmental costs to the larger community.

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Table 1. Definition of Variables Used in the Logit Analysis and the Descriptive Statistics

Variables	Definition of Variables	Classifi-cation	Mean	Standard Deviation	Expected Sign
***Dependent Variable*:**					
PART	Participation	Dummy	.303	.459	
Independent Variables:					
Gender	Male	Dummy	.877	.329	-ve
Race	Minorities	Dummy	.433	.495	-ve
Education	College Grad	Dummy	.304	.460	+ve
Age	Actual Age	Continuous	59.5	11.63	+ve
Part-time	Part-time farming	Dummy	.439	.496	+ve
Participation in other Programs	Other non-cost-gov. program	Dummy	.185	.388	+ve
Membership in Conservation Organization	Any Conservation Agency	Dummy	.009	.286	+ve
Total Acres (Whites)	Owned + Rented Acres	Continuous	143	336	+ve
Total Acres (Minorities)	Minority-Owned + Rented Acres	Continuous	138	297	+ve
DIST 1	Agric District	Dummy	.171	.377	?
DIST 2	Agric District	Dummy	.262	.441	?
DIST 3	Agric District	Dummy	.116	.320	?
DIST 4	Agric District	Dummy	.183	.386	?
DIST 5	Agric District	Dummy	.134	.341	?
DIST 6	Agric District	Dummy	.131	.338	?

Table 2. Parameter estimates and statistical relationships of factors affecting participation in cost-share programs without the regions

Variables	β Coeff.	Stand. Error	Wald Statistics	Sig Level	Change in Probability
Constant	-2.6284	.5714	21.1585	.000	-
Males	-.3513	.2580	1.8534	.1734	-.01616
Minorities	.2341	.2494	.8813	.3479	.01794
College Graduates**	.4662	.1888	6.0972	.0135	.04315
Age**	.0183	.0077	5.7096	.0169	.00266
Part-time Farmers	.1997	.1852	1.1636	.2807	.01487
Participation in other Programs	.0694	.2233	.0966	.7560	.00463
Membership in any Cons. Organizations*	.5279	.2975	3.1496	.0759	.05129
Total Acres (White)**	.0042	.0008	27.8389	.000	.00044
Minority-owned Acres	.0006	.0014	.1984	.6560	.00032
Log-Likelihood Ratio Test					92.99
Nagelkerke R^2					0.17
Prediction Success					68.7

** denotes significant at 5% level
* denotes significant at 10% level

Table 3. Parameter estimates and statistical relationships of factors affecting participation in cost-share programs with the districts

Variables	β Coef.	Stand. Error	Wald Statistic	Sig. Level	Change in Probability
Constant	-2.8479	.6347	20.1351	.000	
Males	-.3351	-.2602	1.6585	.1978	-.01281
Minorities	.2374	.2522	.8866	.3464	.01514
College graduates**	.4454	.1898	5.5109	.0189	.03389
Age**	.0199	.0078	6.5395	.0106	.00266
Part-time Farmers	.2008	.1863	1.1625	.2809	.01241
Part.in other Programs	.0584	.2242	.0679	.7945	.00319
Memb.in any Cons. Org*	.5453	.2992	3.3202	.0684	.04507
Total Acres (White)**	.0042	.008	26.9419	.000	.00037
Minority acres	.0007	.0014	.2922	.5888	.00046
District 1	.1980	.3276	.3653	.5456	.01220
District 2	.1381	.3000	.2120	.6452	.00808
District 3	.3895	.3509	1.2320	.2670	.02828
District 4	-.0839	.3249	.0667	.7962	-.00403
District 5	.0826	.3468	.0567	.8118	.00460
Log-Likelihood Ratio Test					95.48
Nagelkerke R^2					.18
Prediction Success					69.16

** denotes significant at 5% level
* denotes significant at 10% level