Factors Influencing Participation in Agricultural Land Preservation Programs

by

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Introduction

Farmland preservation programs can help maintain a land base for the agricultural economy, provide the amenities of open space and rural character, slow suburban sprawl, provide critical wildlife habitat, and reduce pollution in areas where suburban development is occurring (Bromley and Hodge; Fischel; Gardner; McConnell; Wolfram). States and counties use a variety of policy mechanisms to slow farmland conversion, including exclusive agricultural and low-density zoning, differential property tax assessment programs, purchase of development rights (PDR) or purchase of agricultural conservation easements (PACE) programs, and transfer of development rights (TDR) programs (Lynch and Horowitz; Parks and Quimio; Duncan; Mulkey and Clouser; Rose). While zoning and differential taxation programs often apply to all agricultural landowners in a region, PDR/PACE and TDR programs are voluntary incentive-based programs. In PDR/PACE programs, a governmental entity purchases the development rights. In TDR programs, landowners are assigned marketable permits based on their right to build on the agricultural land. They can sell these permits to a second party such as a developer in a private transaction, who then uses them to increase permitted density in a planned growth or receiving area. The sale of development rights results in a conservation easement being placed on the land, which restricts the current and all future owners from converting the farm to residential, commercial, or industrial uses. These easement restrictions have been upheld in court (Danskin).

Almost 50 governmental entities have implemented TDR and PDR/PACE programs to permanently preserve farmland (American Farmland Trust). Public support for preserving land is highly evidenced by the voter approval of 72 percent of the 240 ballot measures in 1998 with $7.5 billion in funding designed to preserve parks, open space, farmland, and other amenities (Myers). Land Trust Alliance data show that 82 percent of 205 similar ballot initiatives passed in 2000, providing more than

$7.3 billion for land conservation.

As PDR/PACE and TDR programs are voluntary, operating them effectively depends on understanding what motivates a farmland owner to participate. We address this question by analyzing the factors influencing participation in farmland preservation programs in four Maryland counties. Data on the characteristics of property owners are combined with spatial data of their land to model participation in Maryland PDR and TDR programs. We model the decision to participate in these programs in a discrete choice framework. As more governments debate the relative merits of beginning or extending these programs, understanding the owner's motivations is crucial to ensuring efficient programs and an adequate level of participation.

A 2000 California study found that the motivations of 46 landowners for joining easement programs included cash payments and a personal desire to preserve agricultural land (Rilla and Sokolow). Earlier Maryland studies found that landowners farther from strong regional development pressure were more likely to join the state program (Pitt, Lessley, and Phipps; Pitt, Phipps, Lessley). Program participants gained the increased value from development but stayed on the farm. Enrollment in California's voluntary differential assessment program was higher for farmers than for absentee landowners, and higher for farms located farther from development activity. Expectations regarding the timing of development were a main factor influencing enrollment (Hansen and Schwartz; Schwartz, Hansen, and Foin).

Farmland Preservation Programs in Maryland

Four Maryland counties -- Montgomery, Howard, Carroll, and Calvert -- are among the top 13 programs in the U.S. when preserved acreage is used as the criteria (Bowers). Montgomery and Calvert counties have both TDR and PDR programs, Howard County has a PDR program, and Carroll

County relies primarily on the State PDR program, Maryland Agricultural Land Preservation Foundation (MALPF). Number of acres preserved by state and county programs are reported in Table 1. Montgomery County had 49,010 preserved acres of farmland, Howard had 18,088 acres, Calvert had 14,804 acres, and Carroll had 31,284 acres. Preserved acreage was 59 percent, 45 percent, 33 percent, and 18 percent of 1997 farmland in the county, respectively (U.S. Department of Agriculture, 1997; Bowers).

The state has lost almost half of its farmland in the last 50 years, dropping from 4 million to 2.2 million acres. The Maryland Office of Planning predicts that if current trends continue, 500,000 more acres of farms, forests, and other open space will be developed over the next 25 years (*Bay Journal*, 1997). This land conversion trend motivated the development of PDR and TDR programs to permanently preserve agricultural land. The individual programs are described below.

Maryland Agricultural Land Preservation Program

In 1977, the State established a PDR program, the Maryland Agricultural Land Preservation Foundation (MALPF). MALPF sets the value of the easements as the lower of 1) a calculated easement value equal to an appraisal value minus the agricultural value, and 2) a bid made by the landowner. If insufficient funds exist to purchase all offers to sell easements landowners have made in a particular year, the farms are ranked by the ratio of the bid to the calculated easement value. Those farms with the highest value per dollar bid are accepted first. The state program had purchased easements on more than 152,288 acres statewide by 1998 (Maryland Department of Agriculture). MALPF claims to have purchased an additional 4,641 acres due to the competitive bidding component than would have been possible if it had paid the calculated easement (Maryland Department of Agriculture). MALPF has set minimum eligibility criteria including that farms must have at least 100 contiguous acres or be contiguous to another preserved farm, and must have at least 50 percent of its soil classified as USDA Class I, II, or III soils or Woodland group I or II. Landowners in all four counties can participate in MALPF. Carroll County farms are preserved through the MALPF program.

County Programs

Calvert County began a TDR program in 1978. Under this program, farmland owners can sell their right to convert their land to another use to a developer, who then uses the rights in a "receiving" area to increase building density where growth is planned. The price is determined through negotiations between the landowner and the developer. Since landowners sell the TDRs directly to the development firms, the developers' demand for increased density and landowners' reservation prices determine the number and price of TDRs sold. The developers' demand is impacted by the area's development pressure and the availability of receiving areas. Eligibility criteria include a minimum of 50 acres and 50 percent prime soil. Calvert has also instituted a PDR program to purchase development rights at the average TDR price. Thus, if developers' demand is low, landowners may sell a limited number of TDRs to the county until county program funds are exhausted.

In 1981, Montgomery County established a TDR program in its 90,000 acre agricultural reserve. Simultaneously, the county changed the zoning from one house on five acres to one house on 25 acres. To compensate for the down-zoning, landowners were given approximately one TDR for every five acres of land. They can use a TDR to construct one house for every 25 acres of their land (the current zoning) and then sell the additional TDRs to developers who can use them to increase density in designated growth areas. Again, the developers' demand and the landowners' reservation prices determine the number and price of TDRs sold. Landowners in the agricultural reserve are eligible to sell TDRs. More recently, in 1990, Montgomery County began a PDR program under which the price is set by a point system based on the land characteristics or an appraisal process. PDR farms must have at least 50 percent Class I, II, or III soils to be eligible.

Started in 1978, Howard County's PDR program initially used two appraisals to determine the easement price. However, in 1989 the program switched to using a point system based on farm characteristics to determine the easement value. Simultaneously, it shifted to an installment payment mechanism. Eligibility standards emphasize the number of acres (100 acres or contiguity to another preserved farm) and quality of soil (on two-thirds of the farm, at least 50 percent of the soil must be classified as Class I, II, or III).

Modeling the Participation Decision

Land ownership may be thought of as a bundle of rights, one of which is to develop the land up to the allowable zoning density. One can sell this particular right without relinquishing ownership of the land. The sale of development rights is similar to the liquidation of a capital asset. In areas with land preservation programs, an agricultural land owner can extract the value of these development rights to the property, receive an annualized net easement payment, E_i, and continue to farm the land forever. Alternatively, the landowner can choose to exit farming and sell the farmland at some optimal date, d_1 , for an annualized net payment of D_i.

Different individuals may receive different levels of utility from owning a farm, from the net returns for agriculture, from the net easement payment, and from the net returns to converting the farmland to a non-agricultural use in the optimal period. The utility of farmland owner i, V_i , can be modeled as a function of the non-consumptive value of owning the farm, $Z_i(X_i,t)$, given the vector of the landowner's and the farm's characteristics X_i, the net annual agricultural returns per acre, $A_i(X_i, t)$, the net annualized value per acre of converting the land from agriculture to another use at the optimal date

d_1, $D_i(X_i)$, the net annualized value per acre from selling the development rights linked to the farm, $E_i(X_i)$, and the annual off-farm income, $W_i(X_i, t)$. Thus the utility for landowner *i* will be maximized by choosing the d such that

$$V_i = \max_{d} \; (1-d)\left[\int_{t=0}^{d_1} U_i(A_i(X_i,t),W_i(X_i,t),Z(X_i,t))e^{-?t}dt + \int_{d_1}^{\infty} U_i(W_i(X_i,t),rD_i(X_i))e^{-?t}dt\right] + d\int_{t=0}^{\infty}[U_i(A_i(X_i,t),W(X_i,t),rE(X_i),Z(X_i,t))]e^{-?t}dt \;,$$

where d =1 if the landowner participates in the farmland preservation program. Otherwise, d =0, and the landowner retains the right to sell the land at the optimal date in the future, d_1 . The discount rate is *r*, *?* is individual *i*'s time preference, and *t* is time. If the landowner's behavior is consistent with a well-defined utility function, he or she will participate in the preservation program *(d=1)* when

$$\left[\int_{t=0}^{d_1} U_i(A_i(X_i,t),W(X_i,t),Z(X_i))e^{-?t}dt + \int_{d_1}^{\infty} U_i(W(X_i,t),rD_i(X_i))e^{-?t}dt\right] < \int_{t=0}^{\infty}[U_i(A_i(X_i,t),W(X_i,t),rE(X_i),Z(X_i))]e^{-?t}dt \;.$$

Data

In the fall of 1999, a telephone survey was conducted of Maryland farmland owners in Carroll, Calvert, Montgomery, and Howard counties by the Maryland Agricultural Statistics Service (MASS). Information on farmer and family characteristics was collected. The names and addresses of farmers with land in the preservation programs (participants) were obtained from the respective county and state program offices. All participating farmers (N=902) in the four counties were included in the sample. A stratified random sample of nonparticipant farmers was selected from the Maryland Office of Planning's tax assessment database. Nonparticipating landowners with agriculturally assessed land that exceeded the minimum zoning requirement (Calvert: 5 acres per house; Howard: 3 acres per house; Carroll: 6 acres per house; Montgomery: 25 acres per house) were included in the population. The stratification was based on the number of participants and nonparticipants in each county and a total of 1,601 non-participant parcels was drawn. Letters (2,503) were sent to inform the landowners of the survey. Ten percent of these letters were returned as undeliverable.

Attempts were made to find telephone numbers for all included participants and non-participants. Telephone numbers could not be found for 424 nonparticipants. Another 324 nonparticipants were deemed inaccessible by MASS either because they had moved, were deceased, or could not be reached after more than 6 attempts. It was also difficult to find phone numbers for the participants. Most of the programs have existed for 20 years and half the participating farmers had joined during the 1980s. Of the total 902 participants, 201 were deemed inaccessible (e.g., had sold the farm, were deceased). No telephone number could be located for another 181 participants. Thus, in total 1,373 people were contacted by phone of which 385 declined to be surveyed and 115 were deemed ineligible (e.g. did not own agricultural land) Respondents who were in 5-year agricultural districts and had not sold a perpetual easement were excluded from the analysis. Therefore, 838 usable surveys remained.

In addition to the survey data collected, ARC/INFO, a geographic information system, was used to extract parcel characteristics (percent of the farm that had prime soils; the percent of land in crops, forest, and pasture; number of acres; and distances in meters to the nearest town, nearest metropolitan area, and nearest preserved farm, and for Calvert County, to the shore of the Chesapeake Bay or major tributary). These parcel-level data were aggregated to the farm level by weighting each parcel's characteristics by the number of acres in that parcel. The survey and spatial data are consistent with those used in previous analyses of farmland values that included proxies for agricultural and development values (Bockstael; Chicoine; Clonts; Dunford, Marti, and Mittlehammer; Elad, Clifton, and Epperson; Hushak and Sadr; Irwin and Bockstael; Nickerson and Lynch; Palmquist and Danielson; Shi, Phipps and Colyer; Vitaliano and Hill).

Agricultural landowners make their participation decision based on the utility derived from land ownership, the net returns to farming, the net returns to converting the land, and the net value of the development rights paid by the preservation program. Higher agricultural returns should increase the likelihood of participating in a preservation program because the owner of a profitable farm would expect a future in farming. In the empirical model, net agricultural returns are proxied by how the land was being used, soil type, and size of the farm. A series of binary variables was constructed to indicate the commodity that had the highest gross sales returns for the farm: *Grains* (cash grains and oilseeds), *High-value* (vegetables, fruit, and horticultural crops), *Dairy*, *Rental Income*, and *Forest*. Livestock, animal speciality products, aquaculture, cotton, and tobacco were the excluded categories. Grain, high-value, and dairy farmers in Maryland are hypothesized to have higher agricultural returns and thus are more likely to participate. Non-farming owners (rental income) and forest landowners were expected to be less likely to enroll.

GIS-computed variables for the percent of prime soils, the percent of land in crops, and the percent of land in pasture on the farm were also included as proxies for agricultural returns. Maryland soils are categorized around six characteristics: agricultural productivity, erosion susceptibility, permeability, depth to bedrock, depth to watertable, and stability as well as their slope. Prime soils were computed based on the characteristics of high agricultural productivity, good drainage, and even slope. A higher percentage of prime soil would indicate higher productivity, thus higher net returns.

Percent of prime soils is expected to be positively related to the likelihood of participating. Percent of cropland is also hypothesized to increase the likelihood of participating. Percent of pasture land is expected to decrease the probability of participating given it usually has a low agricultural value. The percent of woodlands was not included.

Parcel size is expected to positively affect net agricultural returns and program eligibility. Land preservation programs often have a minimum acreage requirement because large farms are perceived to assist in preserving the agricultural economy. Acreage is included non-linearly as number of total acres divided by 100 and this number squared. Eligibility to enroll may also depend on proximity to other preserved parcels. Preservation programs prefer farms next to other preserved farms to ensure the existence of large contiguous blocks of farmland. Two variables for proximity are included: a binary variable if the farm is within one mile of another preserved farm, and a continuous variable measuring the distance in meters divided by 10,000 to the nearest preserved farm within one mile. In addition to the program's preference, having a preserved parcel nearby may decrease the transaction costs of learning about the available programs. Talking over the fence about the benefits and procedures of preservation may motivate additional neighbors to participate. Therefore, proximity to preserved farmland is expected to increase a landowner's likelihood of joining the preservation programs.

Transaction costs of participation are proxied by how one heard about the program. We include binary variables equal to one if the survey respondent had heard about the program through a neighbor, through the newspaper, or through an Extension agent as opposed to other sources. Hearing about the program from a neighbor or friend is hypothesized to positively impact the likelihood of participating. Similarly, learning about the programs and eligibility requirements may take less time through a newspaper or an Extension agent than through the excluded categories of word-of-mouth, workshop on preservation programs, a banker, a preservation program administrator, and Farm Bureau meeting.

Net returns to converting or selling the land for another use are proxied by distances to the nearest town and distance to the nearest metropolitan area, either Washington, D.C., or Baltimore. Farmland near local towns may have a higher net return to development; therefore, farmers closer to the nearest town are expected to be less likely to join. Similarly, as distance to the nearest city decreases, net returns from selling the farm are likely to increase. This relationship between distance and land value could be nonlinear. For example, if the parcel is within 50 miles of Baltimore, the city may influence its land value. Beyond 50 miles, the city's influence may be insignificant. Therefore, a squared term of distance to the nearest city and nearest town is included to allow for this possibility. Proximity to both town and city is expected to decrease a landowner's willingness to participate in the preservation program. Distances to town and city are measured in meters as the crow flies and then divided by 10,000 and 100,000 respectively. The distances in miles are included in the descriptive statistics in Table 2 and Table 3 for interpretation purposes. Calvert County farms close to the waterfront may have a higher net return for developing the land. Therefore, the distance in meters to the Chesapeake Bay or major tributary for Calvert farms (divided by 10,000) is included in the analysis. Proximity to the water is expected to decrease a landowner's likelihood of participating.

Some variables will affect both the agricultural and development value of the farmland. For example, the percent of prime soils can make the land attractive for both agriculture and development. Prime soils tend to be more permeable and have little or no slope which makes them relatively attractive for development as well as to till. In addition to impacting development value, distance from the city could increase the net agricultural returns by decreasing transportation costs or providing marketing opportunities. It could also decrease agricultural returns by increasing the level of nuisance complaints from non-farming neighbors.

Binary county variables for Carroll, Howard, and Montgomery counties account for differences in the average returns landowners expect to receive for selling development rights, county-level services, permitted zoning densities, and preservation programs.

In addition to the farm characteristics, individual characteristics may affect the utility an owner receives from owning the farm and the price the individual is willing to accept for the development rights. Owners may also have different rates of time preferences. Some owners may not want to wait until the optimal date to develop, d_1 , if selling one's development rights would provide an income stream sooner. In addition, owning a particular farm may have non-consumptive value for the owner. Rilla and Sokolow found that non-consumptive motivations such as a desire to preserve the land in agriculture or for the heirs was frequently mentioned as a reason for selling an easement. If the farm has been in the family and a child plans to take over the farm, a bequest motivation may increase one's willingness to join the program. We include the number of years the family has owned the farm and a binary variable for whether they have a child who plans to continue farming. Similarly, if one's parents had farmed, farming may be part of one's heritage and an owner may be more likely to participate. Education and experience on a farm may affect the relative agricultural returns and alternative income opportunities. Binary variables for whether the owner has a college or post-college degree, whether he or she uses a computer in the farm business, and the number of years the individual has owned the farm are used to proxy both agricultural and alternative income opportunities. A binary variable is also included to indicate whether the family earns 25 percent or less of its income from the farm. A smaller share of farm income is expected to decrease a landowner's probability of joining.

Table 2 reports the variables and basic descriptive statistics for the entire sample, and by participants and non-participants. Table 3 gives the statistics by county. On average, farms have 50 percent prime soils, with participants having slightly less prime soils than non-participants. Howard County has the highest overall percent of prime soils per farm (81 percent). Cropland accounts for 50 percent of farmland area: 57 percent for participants' land and 44 percent for non-participants'. Carroll and Howard had a higher percentage of land in crops than Calvert. The average distance to Baltimore or Washington, D.C., is 26.65 miles, with little difference between participants and non-participants. Calvert farms are farthest away, at 34 miles, and Howard farms are closest, at 17 miles. Participants are much more likely to be within a mile of a preserved farm (95 percent) than non-participants (63 percent). More Montgomery farms (87 percent) and Howard farms (81 percent) were within a mile of a preserved farm than Calvert (67 percent) and Carroll (66 percent) farms. Participants owned an average of 126 acres, compared to 37 acres for nonparticipants. Average number of acres ranged from 85 (Montgomery) to 51 (Calvert).

Over a quarter of participants had children who planned to continue farming, compared to 12 percent for non-participants. More than half of the respondents in both categories had parents who had farmed (59 percent). More than a quarter (28 percent) of the survey respondents heard about the preservation programs through the newspaper -- 8 percent hearing from a neighbor and 6 percent from an Extension agent. Three-quarters of the respondents made less than 25 percent of their income from farming -- 86 percent for non-participants and 59 percent for participants. Carroll County farmland owners accounted for 31 percent of the sample, Montgomery County for 30 percent, Howard County for 18 percent, and Calvert County for 21 percent.

A total of 838 observations were available for use in the empirical model. The geographic information was complete for all 838 observations. However, only 537 respondents had complete information for all the included survey variables. Some people would not give the percent of income from farming, others did not specify which crop provided the highest gross revenue, others did not provide family information such as whether a child planned to continue farming, whether parents had farmed, education, number of years they had owned the farm, number of years the family had owned the farm, and if they used a computer. In order to make use of all 838 observations, we created binary variables equal to one if the data was missing (Dincome =1 if share of income was missing) and then transformed the respective variables (share of income) to equal zero. We then included these binary variables in the regression to determine if this transformation was significant in the estimation. Three binary variables were created: for share of income, crops, and family variables.

Econometric Issues and Results

Although an individual's utility in the two states (participating ($d=1$) and non-participating($d=0$)) is not observed, there is some probability that $V_i(d=0) > V_i(d=1)$. We can formulate the participation decision P_i such that $P_i = 1$ *if* $V_i(d=1) > V_i(d=0)$ and $P_i = 0$ *if* $V_i(d=1) < V_i(d=0)$. Several authors have used a similar approach to explain participation in voluntary programs (Konyar and Osborn; Calvin; Shoemaker; Chambers and Foster; McLean-Meyinsse, Hui, and Joseph). The empirical form of the model is $V_{i1}(d=1) = x_i \beta_1 + \mu_{1i}$ and $V_{i0}(d=0) = x_i \beta_0 + \mu_{0i}$, where x_i is a vector of observed characteristics, μ_{ij} are any unobserved characteristics for the dth state, and β_j are the vectors of parameters to be estimated. Thus the estimated equation is $V_i = x_i(\beta_1 - \beta_0) + (\mu_{1i} - \mu_{0i}) = x_i a + e_i$ where $a = \beta_1 - \beta_0$ and $e_i = \mu_{i1} - \mu_{i0}$. The vector, x_i, includes characteristics of the individual farm (e.g., soil quality, land use, distance to town and city), and of the individual owner (e.g., education, income from farming, years farming, history of farm). The error term is assumed to have a normal distribution so that $e_i \sim N(0,1)$. Thus the $Prob(P_i = 1) = Prob(e_i > -x_i a) = 1 - F(-x_i a)$ where F is the cumulative distribution function for e_i (Maddala, 1983). The likelihood function is: $L = \prod_{P_i=0} \Phi(-x_i\alpha) \prod_{P_i=1} [1-\Phi(-x_i\alpha)]$. The log-likelihood of this function is maximized with respect to the α.

The empirical equations were estimated using a probit model where the discrete dependent variable was participation in a preservation program (1 if yes, 0 if no) employing Limdep Version 7 econometric software. The first model contained the county binary variables to compute differences across counties. In running diagnostics on the regression estimation, evidence of heteroscedasticity was found. Therefore, the likelihood equation was adjusted and a maximum likelihood approach is used for the estimation of a weight matrix simultaneously with the estimation of the coefficients (Greene). A probit model with multiplicative heteroscedasticity is estimated assuming $\varepsilon_i \sim N(0, \exp(\gamma' w_i)^2)$ where w_i is the vector of variables that impact the heteroscedasticity and γ is the vector of weight parameters to be estimated. Thus the likelihood function is $L = \prod_{P_i=0} \Phi[\frac{-x_i\alpha}{\exp(\gamma' w)}] \prod_{P_i=1} [1-\Phi[\frac{-x_i\alpha}{\exp(\gamma' w)}]]$.

This model differs from the basic probit model only in the different structure of the variance term. Because the log-likelihood function for this model is not globally concave, the default algorithm is DPF rather than Newton's method (Greene, 1995). The binary variable for Montgomery County and the variable for distance to town were significant causes of heteroscedasticity based on a Log-likelihood ratio test between the uncorrected regression and the corrected regression. Table 4 reports the coefficient estimates for this model.

Overall, the general regression with 838 observations performed well, the Chi-squared statistic for goodness of fit of the overall model was 583.52 and was significant at the one percent level. The model correctly predicted 267 out of 326 participants, and 454 out of 512 participants given a 0.50 threshold level. The likelihood of participating increased significantly if a preserved farm was within a mile, as the distance to the city increased, as the number of years the farm had been in the family increased, if the children intended to continue farming, and if the owner had heard about the program from a neighbor or an Extension agent. The likelihood of participating decreased as the percent of prime soil increased, as the distance to the nearest preserved farm increased, if one's parents had farmed, if the preservation programs were heard about via newspapers, and if the share of income from the farm was less than 25 percent. The likelihood of participating was not significantly affected by the percent of cropland or pasture, by the distance to nearest town, by the number of years the respondent had owned the farm, by the respondent's education, by whether the respondent used a computer, by the commodity grown, or by the county where the farm was located.

These results to a large extent were as hypothesized. Lower development values, high non-consumptive use value, and low transaction costs appear to dominate the decision making. However, some of the results were contrary to our expectations. For example, we expected that the percent of prime soils would increase agricultural returns -- it is possible that prime soils increase development returns more than agricultural returns, thus resulting in a negative effect on participation. Nor did percent cropland or percent pasture appear to impact the decision. The commodity grown as an agricultural proxy did not fare well either. The number of years of farm ownership, educational level, or use of computer in the farm business did not have statistically significant coefficients. The only variable used to proxy agricultural returns that impacted the likelihood of participating was number of acres in the farm. Thus it appears that the variables included to proxy agricultural returns did not weight heavily or did not perform well in explaining the landowner's decision to participate in the preservation program. On the other hand, being within a mile of another preserved parcel positively influenced participation. This result may indicate that farmers near preserved parcels expect agriculture to remain viable in the future.

Distance to nearest city influenced the decision as expected, although distance to town did not have a significant coefficient. Towns vary greatly within and between these counties, and distance to city appears to be a better proxy for immediate development value. Likewise, the distance to waterfront variable in Calvert County did not explain the participation decision. Some of this waterfront land may not be suitable for development or it could be that most of the land already has a house constructed on it. Alternative income opportunities may have made selling for development more attractive but education was also not significant. However, people whose income from farming was less than 25 percent of their total income were less likely to preserve their land, all else the same.

The number of years the family had owned the farm was positively related to participation, indicating that non-consumptive value may be high. In addition, having a child who planned to continue on in farming increased one's likelihood of participating. Contrary to our expectations, the individual's length of ownership had no significant impact on the probability. If the person had inherited or purchased the farm from the parent, the actual transfer may have happened much later than the person's farming of the land. Or the increased length of ownership may be a proxy for age. As the farmer approaches retirement age, he or she may think selling the farm will be the best way to have a nest egg for retirement. Another surprising result was that a person was less likely to participate if his or her parents had farmed. The high correlation between having parents who had farmed with the number of years the farm had been in the family (?=.45997) may partially explain this negative sign. Similarly, the number of years the farm had been in the family and the number of years the owner had owned the farm were also correlated (?=.33696). These results could be counterbalancing, and the insignificant results for the number of years the respondent had personally owned the farm could be due to multi-collinearity.

Table 4 also reports the coefficient estimates for the general model using only those observations for which we have responses on each survey question for comparison purposes. The two models generated similar results. Most coefficient estimates were qualitatively and quantitatively similar. A few variables were statistically significant in the smaller model that did not appear in the larger model, such as percent of cropland positively impacting participation, and the number of years the respondent had owned the farm and growing high value crops negatively impacting participation. Distance to nearest city, on the other hand, was not significant, nor was the number of years the family had owned the farm. As mentioned above, the number of years the family had owned the farm and number of years the respondent had owned the farm were correlated; thus a switch in significance from one to another suggest it is the overall impact of the family variables that matters not the value of any one. Distance to city and percent of cropland were spatial, not survey, data, and therefore were collected for each observation. Including the dummy variables for missing survey data allowed the use of all spatial data in the regression.

The problem with the initial uncorrected for heteroscedasticity model could be one of specification error (or functional form) rather than heteroscedasticity (Greene 1993). Therefore, in addition to estimating the basic model corrected for heteroscedasticity, a second model was estimated using county interaction terms. In the second model, we hypothesized that certain variables would have different marginal contributions to the likelihood of participating by county. Thus county-specific interaction terms (variables multiplied by the respective county binary variable) were included for each variable except income. Using a log-likelihood test between the first (non-interacted) model and the second (interacted) model, the null hypothesis that they are the same is rejected, *(?^{2}= 108.6, d.f. =71)*.

The results for the second model are given in Table 5. The null hypothesis that all the coefficients in the county interaction model are zero is rejected, (*?^{2}=692.7, d.f. =106)*. Table 5's base case reports the general influence of each variable, with Calvert County being the excluded county. Table 6 gives the marginal effects of all the variables calculated at the mean of the entire sample. For the binary variables, the marginal effects are computed as probability of participating if the variable equals *1* compared to probability of participating if the variable equals ***0*.** The base coefficients on the variables of number of acres, being within a mile of a preserved farm, the number of years the family had owned the farm, having a child who planned to continue farming, growing grains, and hearing about the program via a neighbor, were statistically significant and positively influenced participation. The coefficients on the distance to the nearest preserved parcel, the binary variable that parents had farmed, on having a dairy, and on earning less than 25 percent of one's income from the farm, were statistically significant and negatively influenced participation. The signs of the coefficients on these variables were similar to those in the non-interactive model. If a preserved farm was contiguous, the probability of participating increased 39 percent. Grains as the major crop increased the probability of participation by 55 percent, while dairy decreased it by 17 percent. If parents had farmed, participation was 60 percent less likely. And if the respondent had a child who planned to continue farming, he or she was 66 percent more likely to participate in the preservation program. Earning less than 25 percent of one's income from the farm resulted in an 18 percent decrease in the probability of enrolling in a program.

Table 5 also reports the different marginal contributions by county. In Howard and Montgomery counties, for example, the probability of participating increases as the distance to the city increases, but is not significant in the base model or for Carroll county parcels. Given the growth pressure in Howard and Montgomery counties, this result is not surprising. In addition, while the overall effect of distance to the nearest preserved parcel (county coefficient plus the base case coefficient) was negative for both Howard and Montgomery, the estimated coefficient for these county-interacted variables were positive, suggesting the contiguous distance effect is less strong in these two counties than in Calvert or Carroll. In Howard, the number of years the family had owned the farm had a negative impact on the probability of joining the preservation program, but having parents who had farmed had a positive effect and increased Howard landowners' probability of joining by 29 percent. In both Carroll and Montgomery, the coefficients were also positive. The marginal effects for these two counties of having a parent who had farmed was to increse the probability of enrolling by 26 percent and 14 percent respectively. Montgomery landowners were less likely to join the preservation program if a child planned to continue farming than farmers in other counties (49 percent instead of 66 percent). Using a computer in the business negatively impacted participation in Howard County relative to other counties (16 percent rather than 35 percent). Only in Montgomery did receiving most of the income from the farm as rental income negatively affect the probability of participating. Also in Montgomery, the impact of hearing about the program from a neighbor was smaller.

Conclusion

Understanding which factors affect a landowner's decision to participate in an agricultural land preservation program is important to designing and implementing effective programs. Using a discrete choice model, we find that farmer and parcel characteristics affect the probability of participating in these programs. Overall, parcel characteristics that affect development value are significant more frequently than those used to proxy agricultural value. In addition, variables used to proxy the non-consumptive value or bequest motivations were important. However, a child's decision to continue the farm may be determined by the expectations for future farming profitability thus this may be a better proxy of expected agricultural returns than the included proxies of percent of prime soils or cropland and crops grown. If it is true that the agricultural value is less important that the development value in a landowner’s decision, program administrators need to ensure that they update the easement values to reflect on-going increases in development value.

The type of preservation program varied by county and all landowners had access to the state program to preserve their land. Landowners in the 4 counties exhibit similarities on some factors such as number of acres, if another preserved parcel is within a mile, if they have a child planning to continue farming, share of income and what they produce. But for others characteristics, the results demonstrate both quantitative and qualitative different marginal contributions to the probability of participating. These factors included the distance to nearest city, distance to nearest preserved parcel, years family owned the farm and whether parents farmed. Given the variance in the county programs by payment mechanism and eligibility criteria, one might have expected more difference in the marginal contributions by county. For example, the number of acres impacted the probability of enrolling in a program. This might be attributed to the eligibility criteria in the state and some county programs. Yet in Montgomery TDR program, a minimum acreage requirement does not exist. However, the contribution of this acreage variable in Montgomery did not vary from the other counties. In addition, a criticism of the MALPF has been its scattered preservation pattern both between and within counties. Yet Caroll landowners which use MALPF do not exhibit a different influence of the proximity to a preserved parcel relative to other counties.

Another concern about the Maryland preservation programs is that they preserve hobby farms rather than working farms. If the goal is to preserve the agricultural economy not just farmland for open space and other reasons, then using limited program money in this may not be optimal. These results suggest that agricultural landowners in farm area (proximity to preserved farms) who are farming the land (a larger percent of income from farming) were the most likely to join, all else the same.

References

American Farmland Trust (AFT). 1999. “Status of State PACE Programs: Fact Sheet” American Farmland Trust, Washington D.C. (1999).

Bay Journal. 1997. “Maryland Enacts Sweeping Growth Management Law,” 7 (3) May.

Bockstael, N. E. “Modeling Economics and Ecology: The Importance of a Spatial Perspective.” *Amer. J. Agr. Econ.* 78(December 1996):1168-1180.

Bowers, D. 2000. *Farmland Preservation Report*. 10(9):1-7.

Bromley, D. W., and I. Hodge. 1990. “Private Property Rights and Presumptive Policy Entitlements: Reconsidering the Premises of Rural Policy.” *European Review of Agricultural Economics* 17(2):197-214.

Calvin, Linda, “Particiaption in the U.S. Federal Crop Insurance Program,” U.S. Dept. of Agriculture, Economic Research Service, Technical Bulletin Number 1800, June 1992.

Chambers, Robert G., Foster William E. , “Participation in the Farmer-Owned Reserve Program: A Discrete Choice Model,” *American Journal of Agricultural Economics*, 65(1) feb. 1983 pg 120-24.

Chicoine, D.L. “Farmland Values at the Urban Fringe: An Analysis of Sale Prices.” *Land Econ.* 57(August 1981): 353-362.

Clonts, Howard A. Jr. 1970. “Influence of Urbanization on Land Values at the Urban Periphery.” *Land Economics* 46(Nov.):489-97.

Danskin, M. “Conservation Easement Violations: Results from a Study of Land Trusts.” *Land Trust Alliance Exchange* winter edition (2000).

Duncan, M. L. 1984. "Towards a Theory of Broad-based Planning for the Preservation of Agricultural Land." *Natural Resources Journal* 24(1): 61-135.

Dunford, Richard W., Carole E. Marti, and Ronald C. Mittlehammer. 1985. “A Case Study of Rural Land Values at the Urban Fringe Including Subjective Buyer Expectations.” *Land Economics* 61(Feb.):10-16.

Elad, R.L., I.D. Clifton, and J.E. Epperson. “Hedonic Estimation Applied to the Farmland Market in Georgia.” *J. Agr. Appl. Econ.* 16(December 1994):351-366.

Fischel, W. M. 1985. *The Economics of Zoning Laws: A Property Rights Approach to American Land Use Controls*. Baltimore, MD: Johns Hopkins University Press.

Gardner, B. D. 1977. "The Economics of Agricultural Land Preservation." *American Journal of Agricultural Economics* 59(Dec.): 1027-36.

Greene, W.H. 1993. *Econometric Analysis*, 2nd edition. Englewood Cliffs, NJ:Prentice-Hall, Inc.

Greene, W.H. 1995. *Limdep Users Manual*, Version 7.0. Econometric Software, Inc.

Hansen, D.E. and S.I. Schwartz. 1975. "Landowner Behavior at the Rural-Urban Fringe in Response to Preferential Property Taxation." *Land Economics* 51 (November): 341-354.

Hushak, Leroy J., and Kazem Sadr. 1979. "A Spatial Model of Land Market Behavior." *American Journal of Agricultural Economics* 61(Nov.):697-701.

Irwin, Elena G. and Nancy E. Bockstael. 2001. "Interacting Agents, Spatial Externalities and the Evolution of Residential Land Use Patterns," Department of Agricultural, Environmental, and Development Economics Working Paper AEDE-WP-0010-01, The Ohio State University.

Konyar, Kazim, and C. Tim Osborn, 1990. "A National-Level Economic Analysis of Conservation Reserve Program Participation: A Discrete Choice Approach," *The Journal of Agricultural Economics Research*, 42(2):5-12.

Land Trust Alliance, "More Than $7.3 Billion Committed To Open Space Protection, http://www.lta.org/policy/referenda2000.html.

Lynch, L. and J. R. Horowitz. 1998. "Comparison of Farmland Programs in Maryland." *The Performance of State Programs for Farmland Preservation*. Proceedings of a Conference in Columbus, Ohio, Sept. 10-11, 113-150.

Maddala. G.S. *Limited Dependent and Qualitative Variables in Econometrics*. New York: Cambridge University Press, 1983.

Maryland Department of Agriculture. 1998. Maryland Agricultural Land Preservation Foundation Report. http://www.mda.state.md.us/agland/preserva.htm

Maryland Department of State Planning. 1973. *Natural Soil Groups Technical Report*. Technical Series. (Dec.)

McConnell, K. E. 1989. "The Optimal Quantity of Land in Agriculture." *Northeastern Journal of Agricultural and Resource Economics* 18(Oct.): 63-72.

McLean-Meyinsse, Patricia E., Jianguo Hui, and Randolph Joseph, Jr., 1994. "An Empirical Analysis of Louisiana Small Farmers' Involvement in the Conservation Reserve Program," *Journal of Agricultural and Applied Economics* 26(2):379-85.

Mulkey, D. and R. L. Clouser. 1987. "Market and Market-Institutional Perspectives on the Agricultural Land Preservation Issue." *Growth and Change* 18(1): 72-81.

Myers, P. 1999. *Livability at the Ballot Box: State and Local Referenda on Parks, Conservation, and Smarter Growth, Election Day 1998*. Center on Urban and Metropolitan Policy, Brookings Institution, January.

Nickerson, Cynthia J., and Lori Lynch, 2001. "The Effect of Farmland Preservation Programs on Farmland Prices " *American Journal of Agricultural Economics*, 83(2):341-351.

Palmquist, R.B. and L.E. Danielson. 1989. "A Hedonic Study of the Effects of Erosion Control and Drainage on Farmland Values." *Amer. J. Agr. Econ.* 71:55-62.

Parks, P. J. and W. R. H. Quimio. 1996. "Preserving Agricultural Land with Farmland Assessment: New Jersey as a Case Study." *Agricultural and Resource Economics Review* 25(1): 22-27.

Pitt, David G., Billy V. Lessley, and Tim Phipps. "Influences of Local and Regional Population Trends and Development Pressures on Participation in Maryland's Agricultural Land Preservation Program," *Landscape and Urban Planning* 15: 337-349.

Pitt, David G., Tim Phipps, and Billy V. Lessley. " Participation in Maryland's Agricultural Land Preservation Program: The Adoption of an Innovative Agricultural Land Policy," *Landscape Journal* 7(1):15-30 .

Rilla, Ellen and Alvin D. Sokolow. *California Farmers and Conservation Easements: Motivations, Experiences, and Perceptions in Three Counties*. University of California, Agricultural Issues Center. Research Paper #4. December 2000.

Rose, J. G. 1984. "Farmland Preservation Policy and Programs." *Natural Resource Journal* 24(3): 591-640.

Schwartz, S.I. , D.E. Hansen, and T.C. Foin. 1975. "Preferential Taxation and the Control of Urban Sprawl: An Analysis of the California Land Conservation Act."Journal of Environmental Economics and Management. 2 (December): 120-134.

Shi, Yue Jin, Timothy T. Phipps, and Dale Colyer, 1997 "Agricultural Land Values under Urbanizing Influences," *Land Economics*, 73(1):90-100

Shoemaker, Robbin, 1993. "A model of participation in U.S. farm programs" U.S. Dept. of Agriculture, Economic Research Service.

U.S. Department of Agriculture, National Agricultural Statistic Service. *Agricultural Statistics*. Various Issues.

Vitaliano, D.F. and C. Hill. 1994. “Agricultural Districts and Farmland Prices.” *J. Real Estate Financ*. 8:213-223.

Wolfram, G. 1981. "The Sale of Development Rights and Zoning in the Preservation of Open Space: Lindahl Equilibrium and a Case Study." *Land Economics* 57(3): 398-413.

Table 1. Number of Acres Preserved by County and Program

	County			
Program	Calvert	Carroll	Howard	Montgomery
MALPF	3,844	31,284	3,937	2,074
County PDR	0[a]	0	12,801	6,353
County TDR	10,960	0	1,350	40,583
Total	14,804	31,284	18,088	49,010

Source: Bowers; Greg Bowen, Calvert County Office of Planning and Zoning

[a]Some of the TDR acres reported above were sold as part of the County PDR program. Greg Bowen of Calvert Office of Planning and Zoning estimates that 2,500 acres of the TDR total acres have been preserved under the Calvert PDR program.

Table 2. Descriptive Statistics for Survey Respondents by Preservation Status

	Total (N=838)		Participant (N=326)		Nonparticipant (N=512)	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Percent of Prime Soils	49.84%	0.40	47.65%	0.38	51.23%	0.41
Percent of Cropland	48.68%	0.35	56.72%	0.30	43.56%	0.36
Percent of Pasture	12.29%	0.23	13.42%	0.21	11.58%	0.24
Distance to Town (miles)	3.55	1.69	3.21	1.52	3.76	1.75
Distance to Nearest City (D.C. or Baltimore, miles)	26.65	7.83	26.69	6.85	26.63	8.41
Distance to Water* Calvert County (miles)	0.32	0.79	0.13	0.49	0.44	0.91
Contiguous preserved parcel within a mile (=1 if yes)	75.42%	0.43	95.40%	0.21	62.70%	0.48
Distance to preserved parcel if with a mile (miles)	0.32	0.27	0.33	0.18	0.32	0.31
Number of acres	71.95	87.86	126.40	110.32	37.28	42.50
Years family owned farm	22.60	34.14	28.16	36.55	18.59	31.74
Years owner owned farm	27.10	16.44	26.72	15.75	27.37	16.94
Child plans to continue farming (=1 if yes)	17.86%	0.38	26.29%	0.44	11.78%	0.32
Parents farmed (=1 if yes)	58.63%	0.49	60.89%	0.49	57.02%	0.50
College Graduate + (=1 if college grad or greater)	60.98%	0.49	61.63%	0.49	60.52%	0.49
Uses Computer in Business (=1 if yes)	37.71%	0.49	42.23%	0.49	34.47%	0.48
Highest Gross Income from						
Grains (=1 if yes)	20.46%	0.40	25.79%	0.44	16.67%	0.37
High Value Crops (=1 if yes)	8.75%	0.28	5.16%	0.22	11.30%	0.32
Dairy (=1 if yes)	8.09%	0.27	14.29%	0.35	3.67%	0.19
Rental income (=1 if yes)	12.05%	0.33	11.90%	0.32	12.15%	0.33
Forest products (=1 if yes)	3.87%	0.19	4.28%	0.20	3.61%	0.19
Heard about Preservation Program from						
Neighbor (=1 if yes)	8.47%	0.28	13.19%	0.34	5.47%	0.23
Newspaper (=1 if yes)	27.57%	0.45	20.86%	0.41	31.84%	0.47
Extension Agent (=1 if yes)	6.09%	0.24	9.51%	0.29	3.91%	0.19
Less than 25% of income from Farm (=1 if yes)	74.83%	0.43	59.32%	0.49	85.59%	0.35
Carroll County (=1 if located in this county)	31.38%	0.46	24.85%	0.43	35.55%	0.48
Montgomery County (=1 if located in this county)	30.19%	0.46	44.48%	0.50	21.09%	0.41
Howard County (=1 if located in this county)	17.54%	0.38	19.63%	0.40	16.21%	0.37

Table 3. Descriptive Statistics for Survey Respondents by County

	Calvert		Carroll		Howard		Montgomery	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Percent of Prime Soils	46.65%	0.35	40.03%	0.39	81.22%	0.30	44.00%	0.41
Percent of Cropland	27.59%	0.31	62.77%	0.29	50.69%	0.36	47.46%	0.35
Percent of Pasture	2.26%	0.12	10.77%	0.21	15.16%	0.26	19.15%	0.27
Distance to Town (miles)	3.96	1.66	3.66	1.64	2.82	1.60	3.56	1.69
Distance to Nearest City (D.C. or Baltimore, miles)	34.43	5.80	29.00	6.17	16.61	4.38	24.67	4.40
Distance to Water* Calvert County (miles)	1.52	1.07						
Contiguous preserved parcel within a mile (=1 if yes)	68.57%	0.47	66.16%	0.47	80.95%	0.39	86.56%	0.34
Distance to preserved parcel if with a mile (miles)	0.34	0.30	0.33	0.30	0.34	0.26	0.29	0.20
Number of acres	50.77	81.69	75.33	75.30	69.43	83.08	84.54	103.19
Years family owned farm	33.31	39.78	19.75	32.32	26.77	36.21	16.75	29.27
Years owner owned farm	25.60	17.30	28.70	15.14	28.50	17.15	25.41	16.66
Child plans to continue farming (=1 if yes)	12.04%	0.33	21.58%	0.41	20.51%	0.41	15.76%	0.37
Parents farmed (=1 if yes)	68.87%	0.47	64.92%	0.48	54.31%	0.50	48.91%	0.50
College Graduate + (=1 if college grad or greater)	55.24%	0.50	46.56%	0.50	65.52%	0.48	76.37%	0.43
Uses Computer in Business (=1 if yes)	31.19%	0.47	29.69%	0.46	40.17%	0.49	48.37%	0.50
Highest Gross Income from								
Grains (=1 if yes)	17.43%	0.38	24.87%	0.43	18.42%	0.39	18.82%	0.39
High Value Crops (=1 if yes)	11.01%	0.31	6.09%	0.24	10.53%	0.31	9.14%	0.29
Dairy (=1 if yes)	0.00%	0.00	15.74%	0.37	7.02%	0.26	5.38%	0.23
Rental income (=1 if yes)	7.34%	0.26	15.74%	0.37	13.16%	0.34	10.22%	0.30
Forest products (=1 if yes)	2.86%	0.17	2.54%	0.16	3.51%	0.18	6.45%	0.25
Heard about Preservation Program from								
Neighbor (=1 if yes)	2.29%	0.15	9.51%	0.29	13.61%	0.34	8.70%	0.28
Newspaper (=1 if yes)	22.29%	0.42	29.66%	0.46	27.21%	0.45	29.25%	0.46
Extension Agent (=1 if yes)	2.86%	0.17	9.13%	0.29	4.76%	0.21	5.93%	0.24
Less than 25% of income from Farm (=1 if yes)	77.45%	0.42	66.31%	0.47	73.87%	0.44	82.95%	0.38

Table 4. Probit Regression Coefficient Estimates for Probability of Participating in a Farmland Preservation Program

Variables	**General Model** (N=537)			**General Model** (N=838)		
	Coeff.		**ASE**	**Coeff.**		**ASE**
Constant	-5.541	**	2.437	-5.985		1.988
Percent of Prime Soils	-0.977	*	0.509	-0.782	**	0.388
Percent of Cropland	1.032	*	0.616	0.387		0.450
Percent of Pasture	0.201		0.822	-0.199		0.639
Distance to Town	1.151		2.304	1.390		1.841
Town distance squared	-2.353		2.124	-1.876		1.680
Distance to Nearest City	12.813		8.092	16.163	**	6.710
City distance squared	-12.558		8.687	-18.408	**	7.457
Number of acres	3.292	**	0.825	3.214	**	0.670
Acres squared	-0.372	**	0.116	-0.376	**	0.093
Contiguous preserved parcel	3.018	**	0.833	3.780	**	0.831
Distance to preserved parcel	-23.615	**	6.391	-26.237	**	5.784
Family Variables						
Years family owned farm	0.780		0.509	0.972	**	0.470
Years owner owned farm	-0.018	*	0.011	-0.014		0.009
Child plans to continue farming	1.259	**	0.527	1.249	**	0.491
Parents farmed	-0.621	*	0.343	-0.533	*	0.304
Education	-0.045		0.330	-0.226		0.292
Uses Computer in Business	0.039		0.328	0.098		0.292
Highest Gross income from						
Grains	-0.023		0.389	-0.241		0.361
High Value Crops	-0.972	*	0.592	-0.512		0.461
Dairy	0.193		0.639	-0.522		0.555
Rental income	0.102		0.436	0.079		0.398
Forest products	-0.571		0.866	-0.584		0.705
Heard about program from						
Neighbor	1.362	**	0.503	1.159	**	0.422
Newspaper	-0.899	**	0.361	-0.817	**	0.311
Extension Agent	0.840		0.513	0.917	*	0.491
Less than 25% of income from Farm	-1.100	**	0.411	-1.165	**	0.375
Carroll County	-0.139		0.713	-0.347		0.568
Montgomery County	1.237		0.837	1.004		0.649
Howard County	1.345		0.924	0.999		0.715
Distance to Water* Calvert County	2.115		1.993	-0.111		1.657
Dummy for Missing Family variables				-0.897		0.733
Dummy for Missing Crop variables				-0.638		0.698
Dummy for Missing Income Variable				-0.565		0.542
Coefficient of Heterogeneity						
Montgomery County	0.718	**	0.204	0.593	**	0.166
Distance to Town	0.675	**	0.341	0.691	**	0.293
Log likelihood	-172.28			-268.280		

Chi-squared	386.3683	d.f. =32	583.530	d.f. =35
Maximum Likelihood R^2	0.513		0.502	
McFadden R^2	0.529		0.521	

Note: Two asterisks (**) indicates that based on an asymptotic t-test, the H_0: B=0 is rejected using a 0.05 criterion. One asterisk (*) rejects using a 0.10 criterion.

	Predicted		
Actual	0	1	**Total**
No (0)	274	37	311
Yes (1)	38	188	226
Total	312	225	537

	Predicted		
Actual	0	1	**Total**
No (0)	454	58	512
Yes (1)	59	267	326
Total	513	325	838

Table 5. Probit Regression Coefficient Estimates with County Interaction Variables for Probability of Participating in a Farmland Preservation Program

N=838

Variables	Base		Howard		Carroll		Montgomery	
	Coeff.	ASE	Coeff.	ASE	Coeff.	ASE	Coeff.	ASE
Constant	23.56	18.84						
Percent of Prime Soils	-0.73	1.01	-0.31	1.35	0.04	1.10	0.77	1.06
Percent of Cropland	1.63	1.13	-1.73	1.37	-1.35	1.39	-1.82	1.19
Percent of Pasture	-9.52	15.04	8.48	15.08	10.18	15.08	8.96	15.05
Distance to Town	3.89	4.91	-3.91	5.75	-0.27	5.78	-3.82	5.19
Town distance squared	-5.91	4.48	5.46	5.12	2.03	5.11	5.27	4.70
Distance to Nearest City	-88.85	65.91	122.44 *	71.04	88.14	68.04	119.94 *	70.88
City distance squared	70.57	56.41	-127.41 *	74.67	-69.55	59.02	-105.63	65.42
Number of acres	3.10 **	1.23	0.45	1.44	-0.22	1.37	-1.85	1.29
Acres squared	-0.33	0.49	-0.09	0.51	-0.23	0.52	0.21	0.50
Contiguous preserved parcel	2.89 **	1.02	-0.76	1.36	-0.17	1.17	0.09	1.34
Distance to preserved parcel	-38.12 **	12.20	23.10 *	13.92	15.54	13.43	26.37 **	12.85
Family Variables								
Years family owned farm	3.79 **	1.64	-4.25 **	1.83	-3.35 **	1.73	-3.30 **	1.71
Years owner owned farm	0.01	0.02	-0.03	0.02	0.00	0.02	-0.02	0.02
Child plans to continue farming	1.95 *	1.10	-0.24	1.34	-1.25	1.18	-2.19 *	1.17
Parents farmed	-2.95 **	1.31	3.54 **	1.38	2.97 **	1.37	2.25 *	1.34
Education	-0.27	0.76	0.83	0.90	-0.45	0.85	0.46	0.81
Uses Computer in Business	1.15	0.87	-1.94 **	0.98	-0.47	0.99	-0.77	0.90
Highest Gross income from								
Grains	1.62 *	0.99	-1.73	1.13	-1.64	1.08	-1.46	1.05
High Value Crops	0.58	0.86	-0.66	1.16	-1.51	1.31	-1.05	0.98
Dairy	-1.22 *	0.74	1.63	1.36	1.27	0.89	XX	XX
Rental income	1.72	1.12	-1.31	1.26	-1.39	1.22	-2.40 **	1.20
Forest products	-0.35	0.80	XX	XX	-0.54	1.38	1.13	1.00
Heard about program from								
Neighbor	2.80 **	1.30	-1.46	1.43	-1.95	1.39	-2.72 **	1.35
Newspaper	-0.50	0.55	-0.32	0.73	0.24	0.67	-0.03	0.60
Extension Agent	0.73	2.49	-0.65	2.61	0.12	2.55	1.40	2.58
Less than 25% of income from Farm	-0.73 **	0.26						
Carroll County	-26.99	19.35						
Montgomery County	-31.71	19.51						
Howard County	-29.64	19.21						
Distance to Water* Calvert County	0.28	1.97						
Dummy for Missing Family variables	-0.47	0.49						
Dummy for Missing Crop variables	-0.23	0.47						
Dummy for Missing income variable	-0.03	0.39						

Log likelihood	-213.955
Chi-squared	692.1739
Maximum Likelihood R^2=.562	
McFadden $R^{2=}$.618	

	Predicted		
Actual	0	1	Total
0	458	54	512
1	47	279	326
Total	505	333	838

Note: Two asterisks (**) indicates that based on an asymptotic t-test, the H_0: B=0 is rejected using a 0.05 criterion. One asterisk (*) rejects using a 0.10 criterion.

Table 6. Marginal Effects for Interacted Model Reported in Table 5

Variables	Base		Howard		Carroll		Montgomery	
	Coeff.	ASE	Coeff.	ASE	Coeff.	ASE	Coeff.	ASE
Constant	5.834	4.430						
Percent of Prime Soils	-0.180	0.245	-0.078	0.336	0.009	0.273	0.190	0.256
Percent of Cropland	0.403	0.271	-0.430	0.334	-0.334	0.341	-0.450	0.288
Percent of Pasture	-2.358	3.569	2.101	3.595	2.520	3.568	2.218	3.580
Distance to Town	0.965	1.181	-0.967	1.398	-0.066	1.429	-0.945	1.251
Town distance squared	-1.463	1.037	1.352	1.210	0.502	1.243	1.306	1.099
Distance to Nearest City	-22.005	15.355	30.321	16.525	21.827	15.874	29.702	16.413
City distance squared	17.476	13.218	-31.552	17.757	-17.225	13.865	-26.160	15.300
Number of acres	0.768	0.249	0.110	0.367	-0.054	0.335	-0.459	0.280
Acres squared	-0.082	0.117	-0.021	0.127	-0.056	0.131	0.053	0.121
Contiguous preserved parcel	0.395	0.100	-0.141	0.173	-0.041	0.260	0.022	0.347
Distance to preserved parcel	-9.441	2.598	5.721	3.134	3.849	3.091	6.531	2.819
Family Variables								
Years family owned farm	0.940	0.340	-1.053	0.393	-0.830	0.370	-0.817	0.366
Years owner owned farm	0.003	0.004	-0.008	0.005	-0.001	0.005	-0.006	0.004
Child plans to continue farming	0.655	0.317	-0.053	0.257	-0.165	0.063	-0.183	0.046
Parents farmed	-0.597	0.192	0.882	0.073	0.861	0.171	0.738	0.302
Education	-0.066	0.179	0.266	0.334	-0.093	0.143	0.131	0.255
Uses Computer in Business	0.345	0.288	-0.190	0.049	-0.094	0.150	-0.137	0.105
Highest Gross income from								
Grains	0.546	0.326	-0.172	0.042	-0.183	0.046	-0.171	0.044
High Value Crops	0.178	0.308	-0.115	0.128	-0.163	0.049	-0.147	0.066
Dairy	-0.166	0.057	0.579	0.442	0.446	0.340		
Rental income	0.594	0.353	-0.159	0.044	-0.167	0.045	-0.178	0.043
Forest products	-0.073	0.139			-0.100	0.176	0.393	0.398
Heard about program from								
Neighbor	0.831	0.160	-0.165	0.052	-0.177	0.046	-0.183	0.046
Newspaper	-0.110	0.108	-0.068	0.132	0.066	0.197	-0.007	0.145
Extension Agent	0.230	0.929	-0.114	0.281	0.032	0.703	0.497	0.944
Less than 25% of income from Farm	-0.183	0.071						
Carroll County	-1.000	0.000						
Montgomery County	-1.000	0.000						
Howard County	-1.000	0.000						
Distance to Water* Calvert County	0.070	0.487						
Dummy for Family variables	-0.105	0.100						
Dummy for Crop variables	-0.054	0.105						
Dummy for Income variable	-0.006	0.096						