Public Support for Farmland Preservation Programs: Empirical Evidence from Connecticut

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Abstract:

This paper investigates the determinants of household support for a purchase of development rights (PDR) program in Connecticut. A weighted probit model is used to explain support for the current program, and an ordered probit model is estimated to investigate support with higher funding levels. The results show high levels of public support across income and geographic differences, although such support is sensitive to program funding levels. Support for the PDR program in Connecticut is positively associated with younger households with children and is strongly tied to maintaining access to locally-grown foods.

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The conversion of agricultural land to other uses has been a policy issue for decades in the United States (Gardner), especially in the Northeast. As one component of farmland preservation policies, sState-funded programs exist to purchase development rights (PDR) directly from land owners. By purchasing such rights, these programs are designed to maintain the agricultural character of privately-owned lands and continue the supply of amenity values to the non-farm population. PDR programs are prevalent in the Northeast due to high urbanization pressures (Heimlich and Anderson).[i] Connecticut established a PDR program in 1978 and has preserved 27,000 acres of farmland since then.

There is a growing literature on the social benefits of farmland preservation. A group of studies estimates willingness to pay for environmental, aesthetic, and amenity services provided by farmland (e.g., Halstead; Bergstrom, Dillman, and Stoll; Beasley, Workman, and Williams; Furuseth; Krieger; and see Poe for a recent overview). Assuming such positive externalities exist, a second group of studies analyzes the potential under allocation of land to agriculture (e.g., Lopez, Shah, and Altobello 1994a; Lopez, Shah, and Altobello 1994b; and Brunstad, Gaasland, and Vardal).

This paper contributes to a third group of studies that focus on public support for specific programs designed to slow the conversion of farmland to non-farm uses. For example, using county-level data for Pennsylvania and Rhode Island, Kline and Wichelns (1994) estimate stronger public support for PDR programs in counties experiencing rapid population growth and increasing property values. Pfeffer and Lapping also find this positive correlation between population growth and support for PDR programs in the Northeast. In one county in North Carolina, Furuseth reports that over 87% of surveyed residents support using public funds to purchase development rights, although only 50% would be willing to pay additional taxes to fund such programs. Furuseth concludes from cross-tabulations that such support is positively associated with higher levels of income, higher levels of education, and being female.

In addition to showing widespread support, the literature also provides information on underlying motives for household support of farmland preservation. In the Furuseth survey data, public opinions were clearly related to both agricultural objectives (food supply, farmland part of local heritage, ensure future food supply) and environmental objectives (open space is good for the environment). Kline and Wichelns (1996) conclude that Rhode Island residents believe that farmland preservation activities should focus on environmental objectives that are distinct from agricultural/amenity objectives (e.g., preserving rural character, scenic quality, and public access to open space). Not surprisingly, the relative importance of such agricultural and environmental motives tend to vary across locations depending on the relative availability of farmland.

The objective of this paper is to understand public support for Connecticut's existing purchase-of-development-rights program. To accomplish this we use survey data from a random sample of Connecticut residents to estimate econometric models of program support. The remainder of this paper is organized as follows. Section 2 introduces the data and discusses the level of support for the current PDR program at current and higher funding levels. Section 3 then develops two models to investigate household-specific determinants of support for the PDR program. For the current program, a weighted probit model is developed that allows for better inference to the state's population. For programs with higher levels of funding, an ordered probit model is estimated. Section 4 presents and discusses the empirical results. Section 5 concludes.

Background and Data

Since being established in 1978, the State of Connecticut's PDR program has purchased the development rights to over 27,000 acres of land at a cost of $81 million (nominal) (CT Dept. of Ag.). In the last two legislative sessions, the Connecticut State Llegislature has discussed continued funding for the State's PDR program. In the 2000 session, a bill (H.B. 5173) requesting a doubling of farmland preservation funding to $50 million over 5 years (about $8 per household per year) was sent to the State Legislature's Finance Committee. Instead of passing this bill, a compromise measure allowed $6.4 million dollars of already allocated, but not spent, bond funds to be disbursed over the next 3 years for farmland preservation. In short, this newly approved funding level is the equivalent of about $2 per household, which is 50% less than the $4 per household average spending level made during 1978-1997 and substantially less than the $8 per household amount originally proposed in the Legislature.

During this PDR funding debate, the Roper Center for Survey Research and Analysis at the University of Connecticut implemented a telephone survey of adult residents of Connecticut the state to investigate state-wide preferences for continued funding of the existing PDR program. After pre-testing the survey instrument, the revised survey was administered to a sample frame that included all telephone exchanges in Connecticut the State with telephone numbers generated through a random-digit-dial telephone methodology to insure that each possible residential telephone exchange had an equal probability of selection. The cooperation rate for the survey--the proportion of eligible households contacted that were actually interviewed--was 48%. In total, 604 interviews were completed.[ii]

After asking introductory questions on other important state issues, the survey provided the following information as background information on the State's PDR program:

> At the present time, the State of Connecticut does have a program that works to preserve farmland. The program buys the development rights from the farmer, which means that the farmer can choose to farm the land or not, but the land cannot be used for non-agricultural purposes, even if the farmer sells the land to someone else. The farmer still owns the land itself, and the public can go on the land only if the farmer gives permission.

After this overview, the respondents were asked, "How much have you heard about this program - a lot, some, just a little, or nothing at all"? The vast majority of respondents, 78%, had heard "nothing at all" about the program. From a policy perspective, this lack of knowledge should be troubling to the State Department of Agriculture and farm groups within Connecticutthe state.

In order to focus the respondents on the actual PDR program under discussion in the Legislature, respondents were then asked if the State Government should continue funding the current Connecticut PDR program at proposed funding levels. A dichotomous choice question was posed as follows:

> Over the ten years from 1988 to 1998, the state spent about $5 million dollars a year to buy development rights to a total of about 11,000 acres of farmland throughout the state. This averages to about $4 per Connecticut household per year. Do you favor or oppose continuing the program?

Despite the low levels of knowledge about the program, Table 1 shows that 79% of the sample supports continued funding of the program at the $4 funding level. In order to investigate whether this positive response was merely due to the low cost of the program, follow-up questions were asked to compare the PDR program to other things the state spends money on.

Overall 79% responded that the PDR program represented “about the same” or “more value for your dollar” as other programs financed with tax dollars. Among the 79% who supported the program at the $4 funding level, 69% thought it was an “excellent” or “good way to spend your tax dollars”, with 29% saying it was “fair” and 2% “poor”. In short, while Connecticut residents are not well informed about PDR programs, they support continued taxpayer funding of a PDR program at the $4 level of funding. These results are consistent with Furuseth, who reports that about 87% surveyed in a North Carolina county support using public funds to purchase development rights.[iii]

Respondents who agreed to continue the current level of funding were then asked whether they would support a higher level of spending. Respondents were allowed to choose one-of-three program possibilities: (1) remain at the current $4 per household funding level; (2) a funding level greater than $4 but less than $8; or (3) an $8 funding level.

For this sub-sample accepting the current program, Table 1 shows that 40% would chose to increase, but not double, the amount spent. A smaller percentage (27%) of this sub-sample would support doubling the funding level. Thus, as consistent with the literature (e.g., Furuseth;, and Pfeffer and Lapping), these Connecticut data suggest the high levels of average support for PDR programs with relatively minor funding levels, commonly found in the literature, are sensitive to different funding levels.

Discrete Choice Models of Household Support

Support for the PDR program is hypothesized to be related to respondents' socioeconomic characteristics, including characteristics of their community and their opinions on the importance of farming and land use in their communities. To investigate these issues, this section develops discrete choice statistical models of household support for continued funding of a PDR program.

A household's decisions to support a PDR program can be organized into a discrete choice framework as follows. Let B*(Z) represent a household's annual willingness to pay to support a PDR program with a household cost of C dollars, where Z are variables representing household characteristics.[iv] Assuming the household says yes to supporting the program if $B^*(Z) - C > 0$, a decision criterion Y can be defined as:

$$Y = 1 \text{ if } B^*(Z) - C > 0$$

$$Y = 0 \text{ if } B^*(Z) - C \leq 0$$

The statistical inference problem then becomes a question of parameterizing the B*(Z) equation which defines the net benefits of the PDR program to households.

A standard random utility model of preference choice (e.g., Manski, p.92 and Greene, p.881) assumes that $B^*(Z) - C$ depends on observable household, community, and market characteristics and, represented here as a linear function $\gamma' Z$, and a random variable ε. This random variable ε describes the parameters of household choice known to the household but unobserved by the researcher and uncorrelated with household characteristics.[v] Letting $B^*(Z) - C = \gamma' Z + \varepsilon$, the probability that Y=1 can be written as:

$$Prob(Y = 1) = Prob(B^*(Z) - C > 0) = Prob(\gamma' Z + \varepsilon > 0) = Prob(\varepsilon > -\gamma' Z)$$

where γ is a parameter vector to be estimated.[vi] Assuming that the disturbance term ε is normally distributed, the distribution's symmetry implies that $Prob(Y=1) = Prob(\varepsilon < \gamma' Z) = \Phi(\gamma' Z)$, where Φ is the normal cumulative density function. With a fully representative sample of the population, the parameters γ governing this decision criterion can be estimated as a standard probit model.

A Weighted Probit Approach

While the sample frame was designed to provide a random sample of the state's households, the resulting data set used for this statistical analysis is not completely representative of adults in Connecticut. Since a goal of this analysis is to provide estimates of γ that are valid for inference to the state level, we use a weighted regression to improve the efficiency of the point estimates and correct the standard errors for heteroskedasticity induced by over-sampling specific groups of the population (StataCorp, p. U-264).

For this analysis, weights were created by the Connecticut Center for Survey Research based on US Census age and gender distribution profiles of the Connecticut population. The weights are defined as the percentage of a particular group (e.g., male between the age of 45-64) in the population divided by the percentage in the observed sample. Four age categories were used for each gender, and the weights (α_i) are normalized to have an average of one. Using this process, observations from groups under-represented in the sample relative to the population of the Sstate receive a weight higher than one. Similarly, over-represented groups receive a weight less than one.[vii]

Adding the probability weights to the model developed in equation (3), the weighted likelihood function to estimate this probit model is:

$$\ln L = \sum_{i, if\ y_i = 0} \alpha_i \ln\ (\ 1 - \Phi(\gamma'\ Z_i)\ ) + \sum_{i, if\ y_i = 1} \alpha_i \ln\ \Phi(\gamma' Z_i\ ).$$

The standard asymptotic covariance matrix for the probit model needs some modification due to

$$V\ (\ \gamma\ ) = D\left(\frac{n}{n-1}\sum_{i=1}^{n} u_{i'} u_i\right)D$$

the weighting procedure. The robust covariance matrix for the estimates is given by:

where **D** is the inverse of the Hessian matrix evaluated at the estimated parameters, and

$u_i=\alpha_i\ [\varphi\ (Z_i\gamma)/\ \Phi\ (Z_i\gamma)]Z_i$ for positive outcomes and $u_i= -\ \alpha_i\ [\varphi\ (Z_i\gamma)/\ (1-\ \Phi\ (Z_i\gamma))]Z_i$ for negative outcomes.

An Ordered Probit Model for Higher Funding Levels

As introduced in Section 2, respondents who agreed to support the $4 per household funding level were asked a follow-up question with three choices of funding levels: $4, between $4 and $8, and $8. For the sub-sample of respondents who agreed to support the $4 program, an ordered probit approach makes best use of the available information to analyze the probability of choosing one of the three possible funding choices. Since at this stage the sub-sample is not intended to be representative of the general population, a weighted model used in the previous section is no-longer appropriate.[viii]

The dependent variable for the ordered probit, Y, is defined as Y = 1 if yes to $4, Y = 2 if greater than $4 but less than $8, and Y = 3 if yes to $8. Given these three categories, the probability of observing an observation is (Greene, pp. 927-928):

$$P(\ Y = j\ ) = P(\ \mu_{j\text{-}1} < \beta'Z + \varepsilon\ LE\ \mu_j\ )$$

where j =1, 2, 3 is the outcome and the cut points μ_1 and μ_2 are estimated together with the parameters β using maximum likelihood methods with $\mu_0 = -\infty$ and $\mu_3 = \infty$.

The Independent Variables

Table 2 provides summary information on the independent variables, *Z*, used for estimating the parameters of the regression models. These variables include household characteristics, location characteristics, and household preferences/opinions.

We hypothesize Based on previous studies, it is expected that younger households with more disposable income, children at home, and higher levels of education will have a higher demand for farmland amenities and therefore be more likely to support farmland preservation. Also we hypothesize that, controlling for age differences, respondents who have lived longer in Connecticut will be are expected to be more likely to support the program because they have a longer experience with farmland amenities in the state. From Table 2, the average age of the respondent (*Age*) was 45 years old, and 42% of households included at least one child (*Child* = 1 if there are children in the household, else 0). On average respondents have lived in Connecticut (*YearsCT*) for 32 years, with average household income (*Income*), as measured in $20,000 increments to $120,000, falling between category 3 and 4 (meaning between 40-60 and 60-80 thousand per year). Respondents are highly educated, with the mean for *Education* equal to 3.22, implying some college education.

Location-related variables include a variable if the respondent reported living in an urban area (*Urban* = 1 if urban area, else 0), and the percentage change in a respondent's town population between 1990 and 1998, *PopChange*, (CT Department of Economic and Community Development). The population change variable, with a mean of almost no change (0.59%), shows wide variation across the Sstate with a population loss in urban areas of up to 17% and population gains of up to 21% in other mainly suburban and rural areas between 1990 to 1998. These population changes reflect a continued 'de-urbanization' and 'suburbanization' of Connecticut. Among the location variables, it is expected that respondents living in an urban area and in towns with lower population growth will be less likely to favor farmland preservation.

Additional information was gathered on household preferences on issues related to farmland preservation. For example, on average, respondents agreed (either mildly or strongly) with the statement that "it is important to maintain farmland in the state for future generations" (i.e., the mean of *Future Farms* in Table 2 is 3.58, where the variable is coded *strongly disagree* = 1, *mildly disagree* = 2, *mildly agree* = 3, *strongly agree* = 4). Respondents also agreed with the statement that "the state should support farms so that we can have locally grown food" (i.e., the mean of *Local Food* is 3.25, with the same coding as for *Future Farms*). An average response of 2.8 for *Sprawl* suggests more divergent reactions to the statement that "there is too much urban sprawl in Connecticut." In addition, we include a measure of experience with farm related activities in the Sstate. At least one member of 82% of the households in the sample visited a farm, farmstand, farmers market, or pick-your-own place during the past year (*Farm Visit* = 1 if yes). The literature suggests that households with farm-related experience and households wanting to maintain farms for future generations would be more likely to support the program.

Empirical Results

The Weighted Probit Model

The parameter estimates and marginal probabilities for the weighted probit model are reported in Table 3 using the explanatory Z variables reported in Table 2.[ix] The model estimates a respectable 84% of the observations correctly, though it tends to overestimate program support. As reported in Table 3, coefficients estimated for seven of the twelve Z variables are significant at the five-percent level. The variables *Child, YearsCT, PopChange, Local Food, Sprawl,* and *Farm Visit* were estimated as positively associated with farmland preservation support while *Age* was negatively associated. In addition, *Future Farms* is positive and significant at a ten-percent level. In sum, the probability of supporting the current PDR program at a $4 funding level is higher for respondents with children, who have lived in Connecticut longer, who live in areas experiencing positive population growth, who visit farming operations, who think sprawl is an issue in this community, and who have relatively strong opinions that maintaining farms in the State is important for access to locally grown food.

The estimated coefficients on *income*, *education*, *gender*, and *urban* are insignificant. These results suggest that, at least at modest funding levels, there is support for the PDR program across a wide socioeconomic and geographic spectrum. Perhaps surprisingly, urban residents' opinions are not different from their rural or suburban counterparts. While not exactly comparable, this result is quite different from the county-level referendum results for Pennsylvania reported in Kline and Wichelns (1994), where metropolitan counties were more likely to approve the PDR referendum.

The econometric results on population growth are consistent with the more aggregate analysis of actual referenda reported in Kline and Wichelns (1994), but the data at the individual level point out some other key factors to farmland preservation support, such as attachment to the Sstate, visiting an agricultural operation, and having a desire to maintain access to locally grown food. These agricultural motives for PDR support suggest that the people of Connecticut are concerned about farmland preservation in a way that is not simply an open space issue.

The Ordered Probit Model

While the results of the previous section suggest which factors are statistically related to support for the PDR program at the $4 funding level, this section presents the results of the ordered probit model discussed in Section 3. Recall that, for those respondents saying yes to the PDR program with the $4 funding level, the follow up question allowed them to agree with one of three categories: yes to $4, or yes to greater than $4 but less than $8, or yes to $8 or greater.

Since this follow-up question was asked after the initial $4 question, the response could be subject to strategic biases. First, respondents might under report their true level of support due to mistrust of how authorities might actually spend the increased monies allocated for the PDR program. For example, a respondent may have ideological reasons not to trust politicians with twice as much money (i.e., $8 per household) for any program regardless of their true support for farmland preservation. Second, respondents might over report their true support level if they believe that they will not actually have to pay the amount requested. For example, poorer people might expect to pay less than their full share of the $8 in taxes and, as a result, might be more likely to say yes to a higher amount.

For the ordered probit estimation, the issue is whether these strategies are significantly correlated with the error term. If strategic motives are correlated with the error term, there is an omitted, unobservable latent variable that violates the assumptions of the ordered probit framework. To remove such bias, a possible solution for strategic biases is to search for proxy variables that are correlated with the omitted "strategy" variable, but orthogonal to the error term. In the case of an over-reporting strategy, the Z variables already includes income, which is perhaps the most likely proxy variable associated with over-reporting. Thus, additional variables are not needed to account for this type of over-reporting bias. If such a bias exists, the resulting coefficient estimate on the income variable would be lower than if the bias did not exist.

In the case of under-reporting strategies by respondents, it is hypothesized that people who have conservative political views are more likely to under report their support for programs with higher funding levels. For example, conservatives may believe that governments waste their money, so that a "conservative" might strategically answer no to higher funding levels. An additional variable measuring the respondent's self-reported political views is included in the ordered probit analysis to account for such potential strategic bias (i.e., *Conservative* = 1 if they report themselves to be a conservative).

The ordered probit results are presented in Table 4. The model estimates significant cut-off points between categories suggesting a reasonable model fit. Consistent with the results from the weighted probit model reported in Table 3, the parameter estimates for *Local Food* and *Sprawl* remain positive and significant at the 5% level and *Age* is negative and significant at a

10% level. At the same time the higher level of proposed funding induces a number of key changes in the determinants of support. *Income* and *Education* are positive and significant at the 5% and 10% level respectively, while *YearsCT*, *Child,* and *Farm Visit* are no longer significant. The positive and significant coefficient on *Income* is especially surprising since strategic bias should bias it downwards. The negative and significant (10%) coefficient on *Conservative* does suggest the some possible strategic, under-reporting due to mistrust, bias in respondents answers.[x]

The relatively large effects implied by the parameter estimate for *Income* suggests that income constraints may overwhelm other considerations when people are considering increasing levels of farmland preservation funding. Figure 1 illustrates how the predicted probabilities for each of the three ordered possibilities change by each of the seven income categories. In Figure 1, the probability of support for the middle category (between \$4 and \$8) stays relatively constant across income levels, while the probability of being in the \$4 category decreases with income and the \$8 category increases.

The ordered probit results imply that levels of funding matters, with wealthier and more educated households most willing to support higher levels of funding for the PDR program. At higher levels of funding, some of the state attachment variables are overtaken by the importance of income and education levels, but concerns about maintaining farms for locally grown food remains strong.

Conclusion

This paper investigates the underlying motives of household support for Connecticut's

PDR program. A weighted probit model is used to explain support for the current PDR program, and an ordered probit model to investigate support with higher funding levels. Several key policy implications follow from the results of this analysis. First, because the public supports low cost PDR programs uniformly across geographic and socioeconomic boundaries, farmland preservation is an issue perhaps best engaged at the state rather than a local level. Second, policy makers should be aware that the uniformity of support breaks down by socioeconomic strata if the costs are raised. Third, in order to respond to the public's desire for local foods, programs to preserve farmland may find more local support if they are effective in preserving working farms not just keeping land from being developed. This may imply rethinking how the programs choose which farms to preserve and developing tools other than PDR programs to maintain a working landscape (see, e.g. Daniels, 2000). The importance of such agricultural motives for PDR program support may have grown over the past few years with increased consumer acceptance of organic agriculture and access to 'whole' foods retail outlets. Future research should explore further how preferences for farmland preservation may be evolving over time.

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Table 1

Support for PDR Programs at Different Funding Levels

	Percent	
Do not support current program ($Y^* < \$4$) [a]	21.3	
Support current program ($Y^* \geq \$4$)	78.7	
		Percent of sub-sample supporting higher levels of funding
$Y^* = \$4$		32.6
$\$4 < Y^* < \$8$		40.3
$\$8 \leq Y^*$		27.1
Total	100	100

a. Note that $Y^* = B^*(Z) - C$ from equation (1).

Table 2

Descriptive Statistics of Independent Variables "Z"

Variable	Mean	Std. Dev	Min	Max
Age	45.21	14.90	17	84
Child	0.42	0.49	0	1
YrsCT	32.46	18.60	1	83
Income	3.61	1.86	1	7
Education	3.22	1.09	1	5
Gender	0.47	0.50	0	1
Urban	0.18	0.38	0	1
PopChange	0.59	5.66	-17.28	21.46
Future Farms	3.58	0.71	1	4
Local Food	3.25	0.96	1	4
Sprawl	2.80	0.97	1	4
Farm Visit	0.82	0.38	0	1

Table 3

Weighted Probit Results for $4 per household Funding Level[a]

Variable	Coefficient	Standard Error	Marginal Probability dF/dx
Age	-0.018**	0.007	-0.004
Child	0.389**	0.198	0.084
YrsCT	0.014**	0.006	0.003
Income	-0.056	0.058	-0.013
Education	0.154	0.095	0.034
Gender	-0.202	0.189	-0.045
Urban	0.193	0.238	0.040
PopChange	0.034**	0.016	0.008
Save Farms	0.227*	0.137	0.050
Local Food	0.416***	0.113	0.092
Sprawl	0.214**	0.094	0.047
Farm Visit	0.517**	0.208	0.135
Constant	-2.159***	0.654	
Log Likelihood	-131.20		N = 353

a. Significance levels: * = 10%, ** = 5%, *** = 1%

Table 4

Ordered Probit Model Results[a]

Variable	Coefficient	Standard Error
Age	-0.012*	0.007
Child	-0.126	0.160
YrsCT	0.007	0.005
Income	0.120**	0.048
Education	0.138*	0.080
Gender	-0.216	0.150
Urban	0.133	0.194
PopChange	0.020	0.013
Save Farms	0.262*	0.148
Local Food	0.451***	0.115
Sprawl	0.195***	0.077
Farm Visit	0.232	0.228
Conservative	-0.275*	0.159
Cut 1	3.086***	0.685
Cut 2	4.365***	0.700
Log Likelihood	-269.63	N = 278

a. Significance levels: * = 10%, ** = 5%, *** = 1%

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[i] For reference, about 900,000 acres of farmland in New England were converted to non-farm uses between 1984 and 1997, which represents about 17% of farmland acres in 1984. In Connecticut, 100,000 acres of farmland were converted to non-farm uses between 1984 to 1997, representing about 20% of 1984 farmland acres (CT Dept. of Ag.). In part to combat the loss of farmland the states of Connecticut, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, and Rhode Island spent $455 million between the late 1970s and early 1990s to purchase development rights on existing agricultural land (Kline and Wichelns, 1994).

[ii] For the econometric estimates presented later, 353 data points are used. While 604 interviews were "completed", several respondents did not provide income information. Given the likely importance of income as an explanatory variable in the empirical analysis, we focused on the sub-sample of 353 complete surveys. Since income was the main reason for an observation to be excluded, we do not think this sub-sample of 353 observations is significantly different than the 604 sample. To verify this hypothesis we estimated a probit model to try to

explain the probability that a respondent completed the survey (as opposed to partially completed the survey). There were no significant parameters in this analysis. Note also that the weighted probit method discussed in Section 3 also partially accounts for this missing data.

[iii] Note that this information on support for an existing PDR program is not attempting to estimate positive externalities, such as amenity values, from existing farmland.

[iv] Household values are likely to be more accurate than individual values, since, as McFadden and Leonard demonstrate, individuals often incorporate whole household values when asked for their own individual value.

[v] For example, this random variable could be correlated with the respondent being an avid gardener or having a favorite uncle who is a dairy farmer. Such information is unobservable in the available data and most likely uncorrelated with the included *Z* variables, but known to the responded and likely to have a strong influence on the person's willingness to support farmland preservation legislation.

[vi] This simple linear form of the model could be generalized to non-linear versions.

[vii]For example, 2.5% of the survey respondents were females between age 18 and 24, making them the most under-represented group. Since they represent 4.96% of the state's population, a weight of 1.9850 is applied to each observation among this group. For reference, males between ages 45 and 64 were the group most likely to respond to the telephone survey and received a weight of 0.7672.

[viii] In some cases, such a two-stage question would give rise to a two-stage sample selection model. Since the independent variables used to describe the $4 equation should all be included to describe decisions about higher value amounts, there are no appropriate exclusion criteria to estimate a sample selection model.

[ix]The marginal probability for variable z_1 is defined as $\partial\Phi/\partial z_1 = \varphi(\quad)\gamma_1$ or the height of the normal density evaluated at the mean of the Z variables multiplied by the coefficient on z_1.

[x]The notion that this variable represents strategic bias is reinforced by estimations of the $4 equation with *Conserve* as an explanatory variable that show a small and insignificant parameter with a t-statistic of -0.33.