Predicting Land Purchase Behavior in a Fast Growth, Intensely Agricultural County

by

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Abstract

Attitudes toward farmland preservation, agriculture, development, and open space are used to predict land purchases in a rapidly developing, agricultural area. Using data from New Mexico land buyers, a qualitative choice model gives probabilities of individuals purchasing irrigated valley farmland or desert mesa land based on attitudes and socio-economic characteristics.

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Introduction

The migration of affluent non-farmers into agricultural areas located on the urban fringe has worked to alter the structure and character of communities throughout the United States. However, almost two-thirds of the total value of U.S. agricultural output is produced in or adjacent to metropolitan counties (USDA - NRCS 1997).

The structure of the U.S. agricultural system has evolved to where less than 62,000 farms (or 3.2%) account for one-half of all sales of agricultural commodities from U.S. farms (USDA - ERS 1997). Seventy-three percent of all U.S. farms report annual sales of less than $50,000, and are classified as "noncommercial" operations. They generally have negative net farm incomes and are supported through off-farm employment (USDA - ERS 1997). These farms account for 10% of total farm sales, and control 33% of all agricultural land (USDA - ERS 1997).

The term "multifunctionality" is used to convey the notion that agriculture plays several roles in society in addition to its primary function of producing food and fiber (OECD 1998). Using the concept of multifunctionality, it has been observed that the majority of U.S. (and Western European) farms which do not produce significant quantities of food and fiber may have important non-food outputs, many of which are public goods. The non-food functions of a local or regional agricultural system may include the provision of environmental benefits (including open space and landscape amenities), and contributions to the viability and diversity of the rural economy. Other

elements of multifunctionality, such as food security, cultural heritage, or social concerns, also have been identified (OECD 1998).

At the heart of multifunctionality is the agricultural activity or the "food function" (OECD 1998). The issue of public environmental or landscape amenity benefits arising from agricultural lands has been recognized and evaluated extensively in past years (Fields 1979; Halstead 1984; Bergstrom, Dillman and Stoll 1985; Bromley and Hodge 1990; Bowker and Didychuk 1994; Rosenberger and Walsh 1997). However, the non-food outputs or services provided by agriculture and produced jointly with food outputs (i.e., the "non-food function") are receiving renewed interest in the U.S. and Western Europe. Agricultural policy reforms in both the U.S. and Western Europe, and greater openness to trade in both regions, have raised concerns that agricultural multifunctionality may be imperiled by reduced government support and decreasing protectionism.

Farmland preservation programs exist in all states (Kline and Wichelns 1996). The most widely used policy methods for reducing farmland conversion throughout the U.S. have sought to affect the economics of farming through the tax structure or with a regulatory process affecting minimum residential lot size. Overall, farmland preservation efforts in the U.S. have been relatively weak, temporary, and have pursued productivist objectives, such as maintaining soils and food output capacity (Kline and Wichelns 1996; Wright 1994). In contrast, more successful farmland preservation efforts in other countries have tended to overtly define farmland preservation as countryside or open space preservation (Altermann 1997).

In the U.S., land has been viewed as a commercial input into a production process, and productivism has been the traditional guiding force behind land use policies

(Bergstrom 1998). The production orientation has met (and surpassed) food and fiber needs to the point where they are no longer a major national concern and many rural areas appear to be moving into a postproductivism era (Bergstrom 1998). The demand for non-food services provided by agricultural systems in high income, wealthy countries appears to be increasing, and the supply of positive environmental externalities may also be decreasing (OECD 1998). The preservation of multifunctional agriculture is not guaranteed in the current era of agricultural policy reform and trade liberalization, where the emphasis is on international competitiveness and reduced production costs. Recognition of and planning for future agricultural multifunctionality is also not consistent with the rationale underlying previous farmland preservation initiatives and policies.

Most crop production in the inter-mountain and Desert Southwest region of the U.S. is located in irrigated river basin areas. This region of the country is also experiencing high rates of population growth and economic growth. Local economies are diversifying and many places have become popular retirement destinations. In the Desert Southwest, increased competition from commodities imported from Mexico has placed additional pressure on local agricultural production. These forces are threatening the food function of agriculture as it exists in aesthetically attractive inter-mountain and desert river basins. Thus, because they are externalities of the production process, the non-food services provided by agriculture are also imperiled. This confluence of forces currently exists and is at a critical stage in Southern New Mexico.

Southern New Mexico

Doña Ana County, New Mexico is the seventh fastest growing metropolitan statistical area (MSA) in the United States (Las Cruces Chamber of Commerce 1998).

The city of Las Cruces is located within this MSA. The county's population grew 66% (from 96,340 to 159,591) between 1980 and 1995; by 2010 it is expected to reach 227,009 (Bureau of Business and Economic Research 1998).

Cash receipts from agricultural commodities in Doña Ana County are consistently the first or second highest of all New Mexico counties (USDA - NASS, various years). There are 96,030 irrigated acres in Doña Ana County, producing primarily cotton, alfalfa hay, chile peppers, lettuce, onions, and pecans (USDA - NASS 1997). The crops are produced in a narrow strip of land along the Mesilla Valley of the Rio Grande, which runs the entire north-south length of the county.

The rural, agricultural ambiance of the Mesilla Valley is a strong drawing point for the region. Advertising by public and private community entities uses agricultural images in an effort to attract visitors, new residents, and new businesses. The chile pepper has become synonymous with the area, and many new residents and businesses have located in former chile fields. The question then arises as to whether or not the same factors that attract people to the area and are important to local quality-of-life may be altered by the new arrivals; thus changing forever the multifunctional nature of local agriculture.

Vegetable production in the region is also under extreme pressure from Mexican imports, a factor which has caused several chile industry participants to predict that the local chile production and processing industry will survive for no more than five years given existing conditions (Mrkvicka 1999). Other commodities produced in the region, usually in rotation with chile crops, represent such small proportions of U.S. output that they are insignificant relative to national supplies.

Over the past two decades, population and industrial growth in the region has occurred in both desert areas above the valley and in irrigated farming areas in the valley. There is currently no shortage of land or water for new residences in the desert or mesa areas of Doña Ana County. However, there are no regulations or planning efforts which are attempting to direct development to the desert and away from the valley farmlands.

Prior research (Harper 1996; Orta and Harper 1997) identified attitudes toward farmland conversion, preservation, and policy alternatives in Doña Ana County. The research reported here follows on these two studies, and applies a methodology for predicting actual land purchase behavior (i.e., valley or desert) relative to land use attitudes and preferences.

Methodology

The Data. A survey of a randomly-selected sample of individuals in Doña Ana County who had purchased land in the county between 1982 and 1996 was conducted in 1997. The survey instrument included a series of questions which evaluated respondents' concerns related to land use and land use regulation. Socio-economic and demographic data were also collected from survey respondents. The data were then used to predict land purchase behavior (valley or desert).

Modeling Techniques. The purpose of qualitative choice models is to determine the probability an individual with a given set of attributes will make one choice rather than one or more alternative choices (Pindyck and Rubinfeld 1991). The logit qualitative choice model is based on the cumulative logistic distribution which is specified as:

(1) $P_i = E(Y_i = 1 \mid X_i) = 1 / (1 + e^{-z_i})$,

where $Z_i = \beta_1 + \beta_2 X_i$, e is the base of natural logarithms, $Y_i = 1$ for choice = 1 and $Y_i = 0$ for choice = 0. P_i is the probability that an individual will make a certain choice when faced with two choices, given X_i (individual attributes or characteristics) (Brown 1991).

Equation 1 above implies that:

(2) $$1 - P_i = 1 / (1 + e^{z_i}) .$$

The odds ratio, or the probability of making one choice relative to the other, is:

(3) $$P_i / (1 - P_i) = (1 + e^{z_i}) / (1 + e^{-z_i}) = e^{z_i}.$$

Therefore, if $P_i = 0.8$ the odds ratio is 4. This means that the odds are 4 to 1 in favor of the i^{th} individual making the choice (e.g., buying valley instead of desert land). Taking the natural log of (3) gives the value of the logit (L_i) as illustrated in (4).

(4) $$L_i = \ln [P_i / (1 - P_i)] = \ln(e^{z_i}) = Z_i = \beta_1 + \beta_2 X_i + u_i ,$$

where u_i is the stochastic disturbance term, and the regression or coefficients for the logit model are estimated using maximum likelihood techniques. A unique value for P_i is found by taking the antilog of (4) and rearranging terms.

After the coefficients have been estimated, the probability a given individual will make a certain choice is calculated by substituting in specific values for the explanatory variables. The marginal effects of changes in explanatory variables can be analyzed by recalculating the probabilities when the variable takes different values with all other variables held constant (usually at their means) (Greene 1993).

Measures of goodness-of-fit used in this research were the likelihood ratio test with a ^{2} statistic, hit-and-miss ratios, and McFadden pseudo-R^2 (Brown 1991). Goodness-of-fit was also evaluated by comparing the actual mean probabilities for the

sample to the predicted mean probabilities generated by the model. The standard t-test was also used to determine if the coefficients were significantly different from zero.

Empirical Model of Location Choice. Respondents to the survey (n = 158) were identified as to whether the land they had purchased was located in the valley or desert areas of Doña Ana County. After model testing, the final model was specified as:

$$(7) \quad LOCATION = \beta_0 + \beta_1 * INCOME + \beta_2 * PREVENT + \beta_3 * RURALQOL + \beta_4 * AGQOL + \beta_5 * NONAG + \beta_6 * COMP.$$

The estimated coefficients for (7), explanatory variable means and definitions are presented in Table 1. All coefficients were significant at the 20% level. This model was chosen for reporting over other specifications based on the measurements of model validity shown in Table 2 and the significance of the coefficients. Table 3 shows the probabilities of location choices for mean and other explanatory variable values.

The probability of a desert location for the respondent's land purchase is positively related to income (i.e., as income increases, the probability of a desert location also increases). Results for the income variable indicate that higher income residents of Doña Ana County have a higher probability of a desert land purchase than low income residents; however, the probability of a valley land purchase is significantly higher for all income groups. Respondents who believe that something should be done about the reduction of agricultural land in Doña Ana County also have a higher probability of desert location.

The opinion that the existence of rural-open areas is important to local quality-of-life is also positively related to the desert location, as is the opinion that some local non-agricultural areas should be restricted from development. People who believe that the existence of rural-open areas in Doña Ana County is <u>not</u> important to their quality-of-life

have an almost 100% probability of being a purchaser of valley land. However, the belief that quality-of-life in Doña Ana County is related to agriculture decreases the probability of a desert land purchase. Support for compensating farmers for lost development income if they keep land in agriculture is also negatively related to a desert land purchase.

Discussion

The positive relationship between income and desert land purchases may be related to the land price differential. Irrigated land in the highly productive farming areas of the county is more expensive relative to desert land regardless of its location. Development on the desert is creating both low income rural settlements with limited infrastructure and services (i.e., *colonias*), and exclusive residential areas which command high market prices. The low initial price of large tracts of desert land provides a large profit margin for developers of both exclusive residential areas and low-income *colonias*. In addition, purchase of extensive tracts of land in some desert areas affords homeowners an opportunity to avoid congestion and maintain a significantly larger buffer zone between themselves and other residents.

Lack of support for farmland preservation is correlated with an increased probability of valley land purchase; however, support for compensating farmers who forgo development of their land increases the probability of a valley land purchase. Purchasers of valley land would hold beliefs inconsistent with their own behavior if they were against the conversion of agricultural land to residential uses, but having purchased valley land they could be expected to want to capture any residual development rights that could be marketed in the future. They may also be aware that reduced land available for development would be expected to increase their own property values.

Consistency was found between results for the question regarding the reduction in local agricultural lands and the belief that the development of some non-agricultural lands should be restricted. The probability of being a valley land purchaser is lowest for individuals holding anti-development sentiments.

As reported above, valley land purchasers are more likely to hold the attitude that the existence of rural-open areas is not important to their quality-of-life. However, the importance of agriculture to an individual's quality-of-life increases the probability they will be a valley land purchaser, a result which would be expected given the scenic attributes of much of local agricultural production. As would be expected, when agricultural production is not considered an important quality-of-life factor, the probability of being a desert land purchaser increases. This attitudinal characteristic resulted in the highest probability for a desert land purchase relative to any of the other attribute values.

Conclusions and Implications

The results here indicate that valley land purchases are correlated with the belief that agriculture provides positive quality-of-life externalities for valley residents. Unfortunately, the long-term existence of these amenities is doubtful, due in part to the urbanization of formerly agricultural lands. It also appears there may be a disconnect between valley agriculture and rural open space in the attitudes held by valley land purchasers, and that they may not see the two landscape elements as mutually inclusive.

These results also raise questions about desert residents' knowledge of and relationship to local agriculture. These area residents may be so physically removed from local production areas, activities, and landscapes that they are not aware of agriculture's presence in the larger community, its contribution to the local economy (including

employment impacts), and other elements of agricultural multifunctionality. Their land purchase decisions work in favor of reduced farmland conversion, but other attitudes held by desert residents could indicate a lack of support for local agriculture.

As agricultural multifunctionality issues become more integrated into the mainstream of development policy due to the demand and supply forces discussed above, planners and policymakers will require tools to assist in the identification and evaluation of land use planning and policy alternatives. In many regions of the U.S. where agriculture may be locally important but not a significant contributor to the national food supply, attitudes toward agricultural open space, and the perceived amenity value of the "countryside" may carry more weight in agricultural preservation than appeals to maintain existing levels of commodity production based on narrowly defined economic values. For many small farms in the Mesilla Valley and other similar regions, their scenic, cultural, heritage, landscape, open space, wildlife habitat, touristic, and community attributes are likely to have much higher socio-economic value than food and fiber output value.

Table 1. Model of Location Choice: Model Results, Variable Means, and Variable Definitions.

Independent Variable	Estimated Coefficient	t - statistic	Mean	Variable Definition
Intercept	-3.5035	-3.020	---	
INCOME	0.0898	1.336	4.9737	1 = total annual household gross income < $20,000; 2 = $20,000 - $29,999; 3 = $30,000 - $39,999; 4 = $40,000 - $49,999; 5 = $50,000 - $59,999; 6 = $60,000 = $69,999; 7 = $70,000 - $79,999; 8 = $80,000 - $89,999; 9 = $90,000 - $99,999; 10 = > $100,000.
PREVENT	0.7188	1.351	0.7089	1 = respondent believes that something should be done to prevent the reduction of agricultural land in Doña Ana County; 0 = nothing should be done.
RURALQOL	1.9000	1.708	0.8924	1 = respondent reported that the existence of rural-open areas in Doña Ana County was important to their quality-of-life; 0 = not important.
AGQOL	-0.7647	-1.508	0.7595	1 = respondent said quality-of-life would be lower if agriculture did not exist in Doña Ana County; 0 = quality-of-life not related to agriculture.
NONAG	0.7863	1.770	0.6013	1 = respondent believes some local non-agricultural areas should be restricted from development; 0 = no restrictions necessary.
COMP	-1.0485	-2.342	0.4304	1 = respondent supports compensating farmers for lost development income if they agree to keep land in agriculture; 0 = does not support farmer compensation.

Table 2. Model of Location Choice: Measurements of Model Validity.

	Predicted Mean Probability of Location Choice from Model Results (%)	Actual Location Choice from Survey Results (%)
Valley	78	77
Desert	22	23
Log of the Likelihood = -76.70225 Restricted Log of the Likelihood = -84.79277 ^{2} = 16.18 (with 6 degrees of freedom) McFadden pseudo-R^2 = .10 Percentage of accurate predictions = 80% Number of observations = 158		

Table 3. Probabilities of Location Choice (Desert or Valley) for Mean Attribute Values and Different Levels of Attribute Values.

Mean Attribute Values:	.80	.20
Total annual household gross income:		
< $20,000	.85	.15
$20,000 - $29,999	.84	.16
$30,000 - $39,999	.83	.17
$40,000 - $49,999	.82	.18
$50,000 - $59,999	.80	.20
$60,000 - $69,999	.79	.21
$70,000 - $79,999	.77	.23
$80,000 - $89,000	.76	.24
$90,000 - $99,999	.74	.26
> $100,000	.72	.28
Should something be done to prevent the reduction of agricultural land in Doña Ana County?		
No	.87	.13
Yes	.77	.23
Is the existence of rural-open areas in Doña Ana County important to your quality-of-life?		
No	.96	.04
Yes	.77	.23
If agriculture did not exist in Doña Ana County would your quality-of-life be lower?		
No	.79	.30
Yes	.83	.17
Should some non-agricultural areas be restricted from development?		
No	.87	.13
Yes	.75	.25
If farmers were to agree to keep their land in agriculture would you support the idea of compensating them for their lost development income?		
No	.72	.28
Yes	.88	.12

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