The Effects of Conservation Easements on Land Values

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Thesis submitted to the Faculty of Virginia Polytechnic Institute and State University in partial fulfillment of the degree of

Master of Science in

Agricultural and Applied Economics

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May 5, 2004

Blacksburg, Virginia

Key Words: Conservation Easement, Land Value, Preservation of Open Space

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(ABSTRACT)

The Conservation easement has become a popular tool for land protection in the past few decades. Whether this development restriction will necessarily decrease the land value is an empirical question. This study employs a hedonic pricing approach to test empirically the effects of conservation easements on land values. The econometric results indicate that conservation easements can slightly increase the land values, but the effect is statistically insignificance. Considering the limited dataset, the interpretation of the results warrant some caution.

ACKNOWLEDGEMENTS

The help and cooperation of a number of individuals underlie the completion of this thesis. Dr. Leon Geyer, my advisor, deserves special recognition for his continuous encouragement and patience to me. Without his support, I can not find this interesting area and complete this thesis. Professor Jesse Richardson provided advice and criticism throughout the project; his patient rendering of insight was an invaluable asset throughout the course of research. Dr. Anya McGuirk gave helpful suggestions concerning the econometric analysis. I learned so many useful econometric tools from her graduate course. Without the knowledge and skills, I would not make it possible. Karen Mundy also contributed substantially to this endeavor. She helped a lot in data filtering and analysis. I thank all of you.

Especially deserving of credit are my parents, who have always provided their unerring support of my study and endeavors. This thesis is dedicated to them.

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Ch 1 Introduction

For the past two decades, the use of conservation easements has been growing rapidly. Their device has become a popular tool for the preservation of open space, ecologically fragile or unique environments, wilderness, or productive forest or agricultural land.

While the concept of easements[1] is old, the easement for land conservation purposes was not seen until the 1930s. This conservation tool did not become widespread in the private sector until the 1980s. From 1988 to 1998, the land protected by local land trusts in fee increased by 176%, but the land protected by conservation easements increased by 378% (Brewer 2003). As of 2000, there are approximately 2.59 million acres of land subject to conservation easements, an increase of 475% from 1990 (www.lta.org).

A conservation easement is a legal agreement that imposes certain restrictions on the amount and type of future use and development of land in perpetuity or for a specific time period, but continues to leave the underlying land use in private ownership. In other words, conservation easements convey specified future development rights to non-property owners who then hold these rights in trust.

Land ownership can be viewed as a bundle of rights, and the development right

1. Easement can be defined as an interest in real property that transfers use, but not the ownership of a portion of an owner's property. (Appraisal Institute, 2001)

is one of them. Imposing a conservation easement is equivalent to giving up the development right without relinquishing ownership of the land (Lynch and Lovell 2002). Basically, there are two major ways to utilize the conservation easement. A land owner can either donate a conservation easement to a land trust or a government agency or sell it through a Purchase of Development Right Program (PDR). Apart from these two major approaches, the Transfer of Development Right Program is another one resulting in a conservation easement.

By donating a conservation easement, a landowner conveys certain rights of the property to a land trust or government agency for the public benefit. The rights conveyed can vary so that they can be tailored to the landowner's desires and the need to protect different conservation values. For example, if a landowner wishes to protect open space and scenic views, the right to develop the open space can be conveyed. A historic building can also be protected through the donation of a historic preservation easement that restricts the owner’s ability to change certain historic features of the structure (Stockford 1990). The incentive for land owners to donate conservation easements includes the fact that a donation may result in reduced federal and state income tax and local real property tax. Under federal income tax law, the donation of a conservation easement is a tax-deductible charitable gift, provided that the easement is qualified and donated in perpetuity. Property tax benefits are determined by state and local governments and may vary.

PDR programs preserve various resources by purchasing the development

right from property owners, resulting in a conservation easement attached to the title of the land. PDR programs can differ from county to county in both payment mechanism and eligibility criteria. A typical PDR program begins with a landowner preparing an application to the appropriate agency. With limited funding, the PDR programs can not protect all the parcels that the land owners or the general public may wish to protect. Hence, based on parcel characteristics, state or county program administrator can select those parcels satisfying certain criteria and try to maximize the social welfare (Lynch and Lovell 2002). Many PDR programs have purchased the development right to protect farmland, thus restricting the current and all future owners from converting the land to a non-agricultural use. In general, the PDR programs define the price or market value of an agricultural easement by determining the present value of an estimated income stream or by use of a point based formula based on soil quality, location and other factors (Nalukenge and Libby 2003). The formal appraisal approach is difficult to apply in reality, because neither the future development rents nor the time of development can be observed. Hence, the point system approach assigning the different monetary values to different land characteristics is strongly recommended.

TDR programs involve with the transfer of development rights between two properties. The price paid for development rights are determined by the negotiation between the owner and the developer. Thus the price might not be related to the parcel characteristics. TDR program usually exist in an area with comprehensive planning and complex zoning. Thus, the TDR program is still a small, esoteric, but technically

interesting approach to land protection (Brewer 2003). Considering that Howard County in Maryland, which is the study area of this paper, primarily relies on the PDR program, I will not put much attention to the TDR program.

As a result of the donation or sales of rights that are relinquished, the fee holder pays property taxes on the remaining value of the property. The value of a conservation easement forms the basis for determining the amount of income tax benefits (donation of easements) or the purchase price (sales of development right) as well as the amount of the changed property taxes. Therefore, the accuracy of this appraised value determines whether the money spent and tax revenue losses are justified. Several valuation techniques are employed, such as sales selection via zoning classification, similar easement sales analysis, before-and-after easement sales analysis, capitalized income via sales-rentals and subdivision development method. No matter what valuation techniques are employed, the value is supposed to reflect the aggregate contribution (positive, negative or neutral) of a conservation easement to the value of a whole parcel. More specifically, the difference between the fair market value of an unencumbered ("Before") parcel and the fair market value of the same but encumbered ("After") equals to the value of a conservation easement.

Whether a conservation easement decreases, increases, or has no effect on the land value depends on the various and competitive market forces and their aggregate effect. I assume that the real estate market is a competitive market and market values of property can truly reflect the demand and supply in the market.

On one hand, the conservation easements usually restrict the potential and

permissible uses of a property. Hence, the restrictions are likely to change the highest and best use of a parcel, and thus reduce the fair market value. On the other hand, the permanently preserved farmland or open space can positively contribute to the value of a whole parcel because of various non-market values they are able to provide. These non-market values can include aesthetic and scenic vistas, hobby farm, outdoor recreation and more privacy.

Another consideration is that for partially preserved land (the conservation easement that does not encumber an entire parcel), the value of the remaining land outside the easement can be worth more than similar land without this amenity. In the aggregate, the value of whole parcel depends on both the proportion and the extent of value enhancement of unpreserved land.

Therefore, conservation easements may not necessarily decrease the value of preserved land. The objective of this study is to test empirically the effects of conservation easements on land values. In other words, I try to explore whether the conservation easement tends to decrease, increase or have insignificant effect on the land values. A hedonic price model is constructed and estimated. The information derived may imply a better formation of policy under which conservation easements can be correctly appraised so that the amount of tax breaks or purchase price can be justified.

Howard County in Maryland serves as the study area. According to Heflin (2002), the county has three "distinctions among local agricultural easement programs: (1) the oldest in Maryland and one of the first in the nation; (2) the first program to

adopt an Installment Purchase Agreement (IPA) system for funding easements, in 1989; and (3) the leading program in the nation in total funds spent ($193 million) for agricultural easement acquisitions". As a suburb of both Washington and Baltimore, Howard County has been rapidly growing and facing intense development pressure since the 1950s. In 1975, a citizens' committee was appointed to study preservation options. Consequently, Howard's easement program was founded and the county began to participate in state funding program through Maryland Agricultural Land Preservation Foundation (MALPF). The county-funded PDR program was established in 1984. From 1998 to 2002, no MALPF easements were purchased and all parcels preserved are through its county PDR program.

The rest of the thesis is organized as follows. Chapter 2 is devoted to the literature review, in which several related studies are outlined. In Chapter 3, an econometric model and its conceptual framework are presented and its statistical adequacy is verified via the misspecification testings. Chapter 4 provides some information about the data set and its sources. This is followed by a report and discussion of econometric results and their implications. Finally, the paper is summarized and future research directions are suggested in Chapter 5.

Ch 2 Literature Review

America loses 1.2 million acres of farmland annually, much of it the best and most productive farmland. The lost land is near where most Americans live (www.farmland.org). Various farmland preservation programs seek to keep farmers working on their land by lowering the burden of real property tax and keeping the land in agricultural use. The purchase of development rights programs are widely used to help preserve the farmland. The first PDR program was initiated by Suffolk County, New York, in mid-1970s. Soon after that, statewide programs started in Maryland, Massachusetts, Connecticut and New Hampshire (Brewer 2003). Like the donation of conservation easement, the purchase of Development Right programs involves voluntariness on the farmer's side. If the farmers or owners are not satisfied with the terms of the deal, they can turn it down. More often than not, farmers or landowners benefit from PDR programs as they receive large cash payments and reduction in real estate taxes. But that all depends on the premise that with a conservation easement through the PDR programs, the land values will necessarily deflate by the amount of the development right sold or donated. A set of studies has focused on the effects of PDR programs on farmland values.

The purchased price for development rights is based on the assumption that the market value of preserved farmland should reflect its present capitalized value of expected net returns from agriculture. In other words, the effect of PDR programs should be negatively capitalized into the market value of farmland. Blakely (1991)

examined how closely the market values of development-restricted PDR lands follow their agricultural-use assessed values. Inconsistent with the theoretical expectation, the result indicates that given a 95% level of significance, the former was significantly above the latter. He attributed the discrepancy to failure of market participants to perceive the permanency of the preservation, insufficient information for land buyers to make rational decisions and positive contribution of rural amenities to land values.

Blakely employed a paired t-test to do the statistical comparison. However, a more systematic method might be to employ a hedonic pricing analysis. Hedonic pricing analysis is a useful tool to predict the relationship of the market price of a given property and the levels of its attributes (Ready and Abdalla 2003). Several related studies (Wang and Silver 2000, Nickerson and Lynch 2001) employ the hedonic price model to investigate the effects of PDR programs on land prices.

Since many PDR programs are funded by a combination of tax revenues, grants and tax-deductible donations, whether the fund is efficiently used is of public concern. Wang and Silver (2000) employed both a hedonic pricing analysis and a survey of professional appraisers in Vermont to address this issue. While development restrictions reduce the market value of rural and semi-rural properties in Northern Vermont, the prices paid by the PDR program are much higher than the estimated market values. The results from the survey also show that the sales of development programs are overpaid. The authors point out several institutional problems of PDR programs, which can lead to the inaccurate appraisals. That is, the programs lack the following mechanisms to ensure that the public is fairly charged: a motivation for

program managers to negotiate the lowest prices, second appraisers to review easement appraisals and a legal mandate to ensure the PDR agencies paying the market value of development rights.

If the preserved land value does not decrease by the full value of development right payment, reducing the purchase prices is warranted. Nickerson and Lynch (2001) estimated a hedonic model in a semi-logarithmic form. The issue of sample selection is addressed, because it is highly possible that participation decision is inherently related to land values and therefore autocorrelation may exist. However a test of the null hypothesis of no selectivity bias indicates no selection bias. The estimation results indicate a statistically insignificant coefficient on the dummy variable that was incorporated to capture participation in the preservation program. Further comparison of the predicted unrestricted price for each restricted parcel with the actual sales price of these parcels shows no statistical difference between the sales prices of restricted and unrestricted parcels. Thus the results suggest that the development restrictions imposed by these preservation programs do not significantly reduce the farmland values. Two possible explanations are presented. First, the land owners and/or buyers do not believe these land use restrictions will be permanently binding. Second, land buyers interested in hobby farms[2] may bid up the prices of preserved land.

As a result of the PDR programs, a conservation easement is imposed and attached to the title of the property. Other lines of studies examine the effects on land values of conservation tools other than conservation easements. Gray et al (1991),

2. A hobby farmer is defined as a census-farm operator who works "full-time" off the farm, is the main operator and his/her census farm does not employ any year round labor. (Boyd 1998)

using data from actual land sales in four counties in Maryland, found that agricultural zoning ordinances do not lower land prices and that general economic trends, such as interest rate and prices for agricultural products have a much greater effect on land price fluctuation. Vitaliano and Hill (1994) examined whether there is a discernible impact on farmland prices of New York's Agricultural District program. The program employs the agricultural use-value assessment to lower property tax burden of land owners. Once again, the estimation results show no detectable effect. Compared with these preservation measures, conservation easements are more direct and permanently binding.

While these studies conduct their analyses from different economic perspective, they tend to reach the similar conclusion that land preservation programs do not significantly deflate land values. The preserved farmland or open space may offer some attractive amenities for those non-farm dwellers. These non-farm dwellers will exhibit positive willingness to pay for the amenities and thus in turn bid up the land prices. This force may outweigh or at least compensate to some extent the negative effect of giving up development rights. How those amenities contribute to land values is more of an empirical question. Some authors have examined the value of amenities, which include open space or farmland.

Cheshire and Sheppard (1995) use data from two British towns to estimate how the values of local patterns of land use and neighborhood characteristics are capitalized into land prices. The relative scarcity of open space surrounding the

residential area determines the effect of open space on land values. More specifically, in those areas where the amount of open space is relatively scarce, open space has a positive effect on the value of residential properties. This result is consistent with the law of demand, given that open space is a normal good.

Open space is the land that has not been improved with buildings (Fisher et al 1991) and has associated with it various potential public goods. These public goods include aesthetic, outdoor recreation and biodiversity values as well as protection from the external costs associated with urban sprawl. Geoghegan (2002) developed a policentric city model, assuming that open space is a public good rather than a private good owned by individuals. The subsequent estimation of a hedonic model of residential land values focused on the effects of differential values of "permanent" and "developable" open space on near-by residential land prices. "Permanent" open space includes parks and land with a conservation easement. The estimation results show that, "permanent" open space increases near-by residential values by three times as much as the amount of "developable" open space, *ceteris paribus*.

Irwin (2002) also explored the effects of open space on residential property values through the estimation of a hedonic model. However, she measured not only the premium carried by preserved open space but also the different marginal values of different types of open space according to land ownership (privately or publicly owned) and land use type (cropland, pasture, and forests that are developable). Two technical issues are addressed in the econometric analysis. First, open space is endogenous to property price in the sense that the developable open space is "part of

the market for residential land and subject to the same economic forces that determine a location's residential value". Hence ordinary least squares (OLS) regression will lead to a biased coefficient estimates. This problem is addressed by using the instrumental variable (IV) estimation. Second, since IV estimation fails to address the problem of spatial correlation, the approach of a randomly drawn subset of data is also introduced. In other words, the author employed a spatial sampling technique to delete observations from the nearest dataset. The econometric results demonstrate a premium associated with permanently preserved and public owned open space relative to developable agricultural and forested open space. Moreover, spillover effects from cropland and pasture on residential property values are greater than the spillovers from neighboring forests.

Chapter 3 A Hedonic Model

Ever since the earlier application of hedonics to model the effects of air-pollution on housing markets, hedonic pricing models have been widely used to value environmental amenities and/or disamenities (Habb and McConnell, 2003). An important hypothesis behind the hedonic price models is that land can be viewed as a composite good and valued for differentiated utility-bearing attributes or characteristics. Based on this hedonic hypothesis, economic agencies can observe the prices for differentiated goods and the specific amount of characteristics associated with them. The observed prices and the specific amount of attributes define a set of implicit or "hedonic" prices (Rosen 1974). The following chapter constructs a hedonic price function and estimating statistically the implicit price of conservation easements and other attributes, such as location and parcel size of the land.

Conceptual Framework

The following discussion of conceptual framework for hedonic land pricing models follows that of Rosen (1974) and Palmquist (2003). It is assumed that the following assumptions are satisfied in the real property market. First, the real property market is competitive and individuals are price takers in the market. However, each property varies and is composed of a variety of characteristics. Hence there is no single uniform price in the market. Second, the supply of real properties is fixed in the short-run. Therefore, the market equilibrium will be determined on the demand side.

In other words, consumers' preference for the characteristics associated with the properties will determine the equilibrium prices in the market.

Each property is associated with *n* objectively measured characteristics described by vector **z** = (z_1, z_2, …, z_n), with z_i represents the amount of *i*th characteristic contained in the property. The equilibrium price of a property is defined as a function of the characteristics associated with the property:

P (**z**) =P (z_1, z_2, …, z_n).

This equation is called the hedonic price function. The equilibrium will persist when consumers have maximized their utility subject to the budget constraint. Consumers are assumed to purchase one property. Suppose consumers have a strictly concave utility function u = U (z_1, z_2, …, z_n, x, β), with β being a vector of the parameters of consumers' preference. Further, suppose the budget constraint is given by

W = P (**z**) + x,

where W is the income and x is a composite bundle of numeraire goods. Thus the problem is reduced to:

Max u = U (z_1, z_2, …, z_n, x, β)

Subject to W= P (**z**) + x.

The first order conditions are:

$$\frac{\partial U(z_1, z_2, \ldots z_n, x, \beta)}{\partial z_i} = \lambda \frac{\partial P(z_1, z_2, \ldots, z_n)}{\partial z_i} \quad i = 1, 2, \ldots, n$$

$$\frac{\partial U(z_1, z_2, \ldots z_n, x, \beta)}{\partial x} = \lambda \qquad \lambda : \text{Lagrange multiplier}$$

W = P (**z**) + x.

Combining the first two equations, we can get

$$\partial P/\partial z_i = \frac{\partial U/\partial z_i}{\partial U/\partial x}$$

Therefore, the marginal implicit price of attribute z_i is equal to the marginal rate of substitution between attribute z_i and numeraire good x. In this analysis, the hedonic pricing model attempts to reveal the expected contribution of each of the characteristics to the land value. The conservation easement is included in the model as a physical characteristic variable and we attempt to test empirically the direction and degree of its contribution to land value.

Empirical Model

Based on the hedonic price function P (**z**) =P (z_1, z_2, …, z_n), we are able to construct an empirical model to test the effects of conservation easements on land values. The model we adopt is of similar form to that used by Vitaliano and Hill (1994) and Nickerson and Lynch (2001). That is,

$$LnPRICE = \beta_0 + \beta_1 LnACRE + \beta_2 DDC_t + \beta_3 DAN_t + \beta_4 DBA_t + \beta_5 DFR_t + \beta_6 LU_t + \beta_7 CE_t + \beta_8 Y98_t + \beta_9 Y99_t + u_t$$

where $PRICE_t$ is the sales price per acre. $ACRE_t$ is the parcel size measured in acres. DDC_t, DAN_t, DBA_t and DFR_t are location variables which measure the distance in miles from the parcel to Washington DC, Annapolis, Baltimore and Frederick respectively. The remaining four variables are dummies denoting land use (agricultural or residential), conservation easement (with or without) and the year in which the sales transaction occurred respectively. The next chapter discusses the

dataset in detail. u_t represents residuals and $(\beta_0, \beta_1, \ldots, \beta_9)$ are parameters to be estimated.

Before making any valid statistical inference, the model should be statistically adequate. In other words, we need to make sure that the model is well specified. Misspecification testing is used to test assumptions underlying the statistical model. Hence, before we proceed to draw any statistical inference from the model, misspecification testing is indispensable. Essentially, all the misspecification tests conducted here are F-tests, in which we are doing regressions for both a restricted model (the Null hypothesis) and an unrestricted model (the Alternative hypothesis). A P-value is reported for each test. A P-value represents the minimum significance level for which the null would have been rejected (Spanos 1999). A lower P-value indicates evidence against the Null. Although some of the variables in our model are in the natural log form, the model can still be viewed as a linear regression model. The following assumptions are supposed to be satisfied for a linear regression model:

(1) Normality. The conditional distribution of dependent variable given the independent variable is normal. This amounts to requiring that the residual should be normally distributed because residuals are calculated for the given values of all independent variables. I conducted four individual tests to assess whether Normality is satisfied. These tests are

(a) The Bowman-Shenton (1975) Omnibus test ~ CS (2)

(b) The D'Agostino-Pearson (1973) Omnibus test ~ CS (2)

(c) The D'Agostino-Stephens (1986) Skewness test ~ N (0, 1)

(d) The D'Agostino-Stephens (1986) Kurtosis test ~ N (0, 1)

For the following assumptions, both an individual and joint misspecification tests are conducted. The individual tests assume that all the other assumptions are satisfied. This is not necessarily the case in empirical modeling. In contrast, the joint tests have fewer maintained hypotheses. Joint misspecification tests are more useful in the sense that they help to identify the most likely problem of the model.

(2) Functional Form or Linearity. The conditional mean should be correctly specified and linear in all the conditioning variables. Basically, I employ auxiliary regressions, KG (2) and RESET (2) to test this assumption. Their Null hypothesis is that conditional mean is linear. KG (2) is based on a regression of residuals on squares and cross-products of original model's regressors. The RESET (2) test is based on a regression of the dependent variable on the original model regressors and a second-order polynomial of the original regression fitted values.

(3) Homoskedasticity. The conditional variance is constant, namely it is free of influence of any conditioning (independent) variables. Two auxiliary regression tests are conducted. The White quadratic test is based on a regression of squared residuals on the squares and cross-products of original model's conditioning variables and White polynomial test is just a general version of the quadratic test. RESET (2) test is based on a regression of squared residuals on selected polynomial of the original model's fitted value. Though based on different forms of regressions, both tests assume that for the unrestricted model, only the current observation will affect the conditional variance. Hence the tests are used to detect static heteroskedasticity.

(4) Parameter Stability. The parameters of interest are time-invariant. The parameters of interest include the conditional variance (which is supposed to be constant in assumption (3),) *and* $(\beta_0, \beta_1, \ldots, \beta_9)$ the coefficients in the conditional mean. I conduct two misspecification tests to detect the existence of trend in conditional mean and conditional variance respectively. Before doing the tests, I sorted the data by parcel size. These tests are still based on regression of residual or squared residuals on original model regressors and a time-trend term.

(5) Independence. Each observation of dependent variables is sequentially and independently drawn from the underlying conditional distribution. This violation of this crucial assumption will lead to autocorrelation in residuals. Two tests are conducted, an autocorrelation test and a more general version of it. The former is based on regressing the residuals on the original regressors and lagged residuals. The latter is based on regression of residuals on original regressors and lagged observations of both dependent and independent variables.

In the joint misspecification tests, I employ the conditional mean test and the conditional variance test. In the former, I test the stability (time trend) of $(\beta_0, \beta_1, \ldots, \beta_9)$, functional from (quadratic) and autocorrelation (lagged residuals). In the latter, we test the stability of conditional variance (time trend), static heteroskedasticity (RESET) and dynamic heteroskedasticity (lagged squared residuals). In joint tests, each of the three assumptions is tested both individually and all together. When tested individually, the other two assumptions are allowed to be lax.

Table 1 reports the results of misspecification tests. The interpretations of

P-values below the table are just crude guidelines. If P-value is greater than 0.1, it indicates no evidence against the null hypothesis; if P-value falls between 0.01 and 0.05, it indicates little evidence against the null; if P-value falls between 0.02 and 0.05, it indicates evidence against the null; and if P-value is lower than 0.01, it indicates strong evidence against the null (Spanos 1999). Almost all the testing results, except for Normal tests, indicate no evidence against the null hypotheses. The Normality assumption is often hard to satisfy given the limited size of our data set and the sensitivity of these tests to outliers. Overall, the statistical model specified is statistically adequate.

Table 1. Misspecification Testing Results

	Name of the Test	P-value*
Individual Tests		
Normality	Bowman-Shenton Omnibus	2.79e-010
	D'Agostino-Pearson Omnibus Omnibus	5.92e-007
	D'Agostino-Stephens Skewness	3.63e-006
	D'Agostino-Stephens Kurtosis	0.00718
Functional Form	RESET (2)	0.556
	KG (2)	0.41
Homoskedasticity (static)	White (Quadratic)	0.995
	White (Polynomial)	1
	RESET (2)	0.557
Independence	Autocorrelation	0.311
	General Autocorrelation	0.967
Parameter Stability	Conditional Mean Trend	0.7378
	Conditional Variance Trend	0.0599
Joint Tests		
Conditional mean	Overall test	0.688
	Parameter Stability (trend)	0.635
	Functional Form (RESET)	0.568
	Independence (autocorrelation)	0.365
Conditional Variance	Overall test	0.967
	Parameter Stability (trend)	0.841
	Static Heteroskedasticity (RESET)	0.767
	Dynamic Heteroskedasticity	0.678

* $p > 0.10$ data indicating no evidence against H_0
$0.05 < p < 0.10$ data indicating little evidence against H_0
$0.02 < p < 0.05$ data indicates evidence against H_0
$p < 0.01$ data indicates strong evidence against H_0

Ch 4 Data and Estimation Results

Data

The data used in the empirical testing and estimation are from Maryland Department of Planning's property Sale Database. The property Sale Database is created on a monthly basis using data obtained from the Maryland State Department of Assessments and Taxations. The Database includes all the real property transactions and the associated property characteristics, transaction dates and owner information. From Maryland Department of Natural Resources, I obtained the information of conservation easements and associate with the corresponding sales parcel through the tax codes (or account ID).

The dataset includes 85 individual parcels of both agricultural and residential land that were sold between 1998 and 2000 in Howard County. These transactions are all private arms-length transfers. In other words, the transactions are made between unrelated parties under no duress. Non-arms-length transfers are not included in the dataset, because their sales values fail to reflect the real demand and supply conditions in the real property market. Among these parcels, 6 are sold with conservation easements and 79 without conservation easements. All of the six parcels with conservation easements are agricultural land. Two of them are preserved through Maryland Environmental Trust, and the rest are protected through The Maryland Agricultural Land Preservation Foundation (MALPF). Most of those sold parcels

with conservation easements are non-arms-length transfers. Another reason for the resulted small sample size is that my focused study area lies in the north-western part of Howard County, where most easements are located. The eastern part of Howard County is heavily urbanized. Table 2 presents a description of the data and summary statistics.

I use sales value per acre as the dependent variable. The sales value of improvements is subtracted from the total sales value of each parcel for two reasons. First, though the dataset contains some information about the improvements, the variation of the improvements can be too great to completely take it into account. Second, if we incorporate the improvement conditions, the addition of more variables are needed. When doing the testings, we may lose degrees of freedom. Therefore, a better strategy would be to only consider the value of land per se.

Parcel size is a crucial factor in the sense that it affects not only the total value of each parcel but also the land value per unit (per acre here). Usually, the larger the parcel is, the less the per acre price. Another consideration is that, large parcels are often located in less developed areas, and thus the price per unit can be relatively lower. Since we care about those parcels with ample open space or agricultural land, small parcels are excluded from the dataset. The smallest parcel with a conservation easement in the dataset is over 82 acres. The smallest parcel unpreserved that I use in the dataset is over 12 acres. The reason for choosing 12 acres as the smallest parcel in the dataset is that if I add more parcels (the size of which is smaller than 12 acres) into the dataset, the problem of heteroskedasticity appears. The variance of residuals for

small parcels is quite different from that of large parcels.

Location is also a key factor affecting the land values. Location can be defined as the time-distance relationships or linkages, between a property or neighborhood and all the other relevant destinations or origins. The distance to large cities reflects development pressures, transport costs and purchasing powers of potential property buyers. We are using four variables to account for this variation, namely the distance to Washington D.C., Annapolis M.D., Baltimore M.D. and Frederick M.D. respectively. Annapolis is the capital city of the State of Maryland, and Frederick is the large city located and closer to the western part (the area where most easements lie,) of Howard County. The advantage of incorporating all these distance variables is that it helps reflect the existence of decentralized employment and entertainment sub-centers. In particular, Howard County is located in the overlap suburban areas of Washington D.C. and Baltimore. Thus, the polycentric city approach is more appropriate than monocentric approach. However, the flip side is that when sample size is limited, this approach can lead to insignificance of estimation result. It is reasonable to anticipate that the longer the distance to big cities, the lower the land price. In other words, the coefficients of these variables are expected to be negative.

The land use of the property is clearly specified in the property Sale Database. Whether the land is of agricultural use or residential use can make a difference to land values. Since agricultural land usually generates lower current income and thus bears a lower price, we would expect this coefficient to be negative. This study focuses on conservation easements' effect. However, I can not get enough data of land parcels

that were sold with a conservation easement during the period of 1998 to 2000. Family conveyance constitutes the major outlet of those parcels' transactions. To take into account the time heterogeneity, we also incorporate dummy variables of years during which the transaction took place.

Econometric Results and Discussion:

We use ordinary least squares to estimate equation:

$$LnPRICE_t = \beta_0 + \beta_1 LnACRE_t + \beta_2 DDC_t + \beta_3 DAN_t + \beta_4 DBA_t + \beta_5 DFR_t + \beta_6 LU_t + \beta_7 CE_t + \beta_8 Y98_t + \beta_9 Y99_t + u_t$$

The results of estimation are presented in Table 3. Most signs of the coefficient are consistent with previous expectation.

The sign of the coefficient on Conservation Easements is slightly positive and statistically insignificant. This indicates that conservation easements may increase the land values, but the effect is not statistically significant. This interpretation warrants some assumption and caution. First, the implicit assumption imposed here is that all the marginal values of all the other parcel characteristics are the same for both parcels with conservation easements and parcels without conservation easements. Second, the number of preserved parcels in our dataset is very limited. This might lead to insignificant estimation result.

As expected, larger parcels tend to receive a lower price per acre. The coefficient is both negative and statistically significant. The coefficients on distances to large cities are negative except for the coefficient on the distance to Frederick. The

four nearby large cities we choose to measure in the dataset constitute a quadrilateral. Figure 1 shows the specific locations of these four large cities in relation to Howard County. While Baltimore, Washington DC, and Annapolis are much closer to the eastern highly urbanized part of Howard County, Fredrick is a major city much closer to the western part of Howard County. Thus if the parcel is much closer to the east urbanized part, it can receive a higher price. This can possibly explain the different signs of coefficients. However, among those distance variables, only the distance to Washington DC is statistically significant. Our limited dataset might cause the insignificance and the econometric regression is very specific to the data we used. Another explanation would be polycentric city approach might dilute the significance of the marginal values from location variables. The coefficient on the land use variable is also consistent with expectation. Agricultural land receives a lower price per acre than residential land does. The coefficient is negative and significant at a 95% level.

Figure 1: The Location of Howard County.

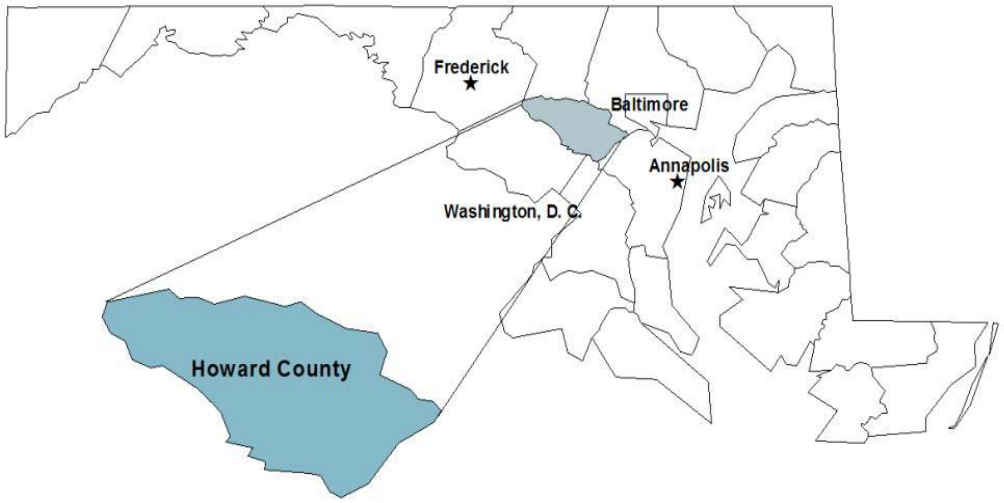

Table 2 Description of Data and Summary Statistics

Variable	Description	Mean	Std. Dev.
PRICE	Sales price per acre	$ 4824	$ 4013
ACRE	Parcel size in acres	50.01	52.57
DDC	Distance to Washington D. C. in miles	38.70	9.52
DAN	Distance to Annapolis in miles	44.11	6.41
DBA	Distance to Baltimore in miles	26.56	4.37
DFR	Distance to Frederick in miles	28.25	6.32
LU	=1 if it is of agricultural land use (=0 if residential)	0.59	0.50
CE	=1 if the parcel has the conservation easement	0.07	0.26
Y98	=1 if the transaction took place in 1998	0.34	0.48
Y99	=1 if the transaction took place in 1999	0.33	0.47

Table 3 Estimation Results

Variable	Coefficient	t-static
ACRE	- 0.8669*	-5.3709
DDC	-0.0202**	-1.7048
DAN	-0.0055	-0.1350
DBA	-0.0136	-0.4160
DFR	0.0076	0.2027
LU	-0.9743*	-4.5173
CE	0.2720	0.5874
Y98	0.3526	1.3298
Y99	0.2714	1.0593

*Statistically significant at %95

**Statistically significance at %90

Ch 5 Conclusions

Conservation enthusiasts usually claim that conservation easements necessarily decrease the land values by relinquishing the development right of land. Tax deductions are justified based on the monetary value the land will lose. It is true that giving up the potential development right and specific uses of a property can restrict the ownership rights, and thus inhibit the flow of benefits (from its highest and best use) and lower the property's value. However, this is just one side of the coin. Accompanied with development restrictions are various non-market values of amenities. These amenities refer to the tangible or intangible benefits of a real property that enhances its attractiveness or increases the satisfaction of the user, but are not essential to its use. The scarcity of these amenities and the purchasing power of the real estate market constitute important market forces influencing the fair market value of the property. The effect of conservation easements on land values depends on the aggregate result of the various conflicting forces.

Based on the theoretical framework of hedonic pricing analysis, I developed an empirical model to test the effect of a conservation easement on land value. Any statistical inference will not be valid until the statistical model is well-specified and statistically adequate (Spanos 1999). The estimation and testing results presented here indicate that conservation easements can slightly increase the property values, but the effect is statistically insignificant. Therefore, the positive effect of amenities

outweighs to some extent or at least compensates the negative effect of development restriction. This is not completely unexpected if we take a closer look at the study area.

Howard County in Maryland lies in the middle of Baltimore and Washington DC metropolitan area. Though most agricultural conservation easements are concentrated in the rural north-western part of the county, they are still in close vicinity to heavily developed area. On one hand, the restriction of development right will certainly affect the highest and best use of the property. On the other hand, these properties can be very attractive and precious, given such limited supply of land with rural amenities surrounded by urban sprawl. According to the interview recorded by Heflin (the project associate of Howard County easement program) in 2002, the resale prices of properties with conservation easement are strong because of the robust demand for rural residence and equestrian community. Furthermore, the county is the 7th wealthiest in the country, having a relatively educated and affluent citizen base. This constitutes a strong purchasing power of the local real estate market. Hence, all these factors contribute to price bidding up of those properties with conservation easements.

Considering the limitation of our dataset, the econometric result and conclusion warrant some caution. In the dataset, there are only 6 resale transactions of properties with conservation easements. The study area is focused and the period of time is limited. In addition, most of the easements are for family conveyance, and thus I cannot get the fair market value from these non-arms-length transfers. The limited

number of data can result in the insignificant coefficient on the variable of conservation easements.

Recall that, by donating or selling the conservation easements the land owners pay property taxes only on the "remaining" value of the land. However, if conservation easements do not decrease the land values significantly, are the land owners still eligible for tax deductions? Moreover, if conservation easements have neutral or positive effect on land values, why should the public pay for them? These questions are not so easy to resolve as they seem to. Several issues need to be further explored.

First, a more comprehensive research would investigate the various conditions in which the conservation easements can positively, negatively or neutrally affect the land values. This will require a large study area in a longer period of time and more detailed information on both the parcel characteristics and the external influences. The complexity of this research also lies in the unpredictability of any change in the future. Land owners, who imposed a conservation easement on their land 20 years ago, might never foresee at that time their property value would increase due to the conservation easement. Similarly, even if from the current perspective, conservation easements do not lower the land values, it is likely that its future benefit flow will be lower than the unpreserved land. The latter has no restriction on its future development and conversion. In a nutshell, it all depends. Most conservation easements are binding in perpetuity, (which is also a controversial issue,) and thus it is least possible to expect a consistent effect of easements on land values.

Second, even if the conservation easement does not decrease the land value (from current perspective), does that mean the public do not need to pay anything to achieve the same conservation purpose? Based on the current appraisal standards ("Before and After Approach") of assessing the conservation easement value, the public should not pay for the easements. However, obviously, if the land owner does not receive tax benefits from conservation easements, the major economic incentive disappears. This seems to be a paradox. Then, how can we decide the amount the public should pay to achieve the conservation purpose? This can require a thorough cost-benefit analysis, which calls for an interdisciplinary research effort (Merenlender et al 2004). Conservation biologists need to contribute their expertise to assessing the efficacy at protecting the eco-system and the ability to respond to social and ecological change over the long term of the conservation easements. Economists need to conduct a welfare analysis based on both ecological facts and market conditions. To achieve the accountability of a conservation approach is never an easy task (Christensen 2003). The simple "bucks and acres" (how much money was raised and how many land was protected) standard is no longer a scientific and systematic metric to assess the success and benefit from conservation easements.

Last but not the least, the equity issue from the conservation easements warrants further examination. Having less tax burden while enjoying more privacy and amenities from conservation easements, are the wealthy gaining disproportionally from conservation easement? Admittedly, preserving more natural habitat and agricultural land can contribute to a better ecosystem that everyone in the society can

benefit from. Nevertheless, privately conserved land also involves the public access issue. If the local PDR or other conservation easement program is funded through both public and private partnerships, does the benefit distribute fairly within the local community (Merenlender et al 2004)? Some critiques have emerged about abuses of conservation easements to create more private gain for the wealthy with scant benefit for the public (McCoy and Harris 2002, Ottaway and Stephens 2003). The big income tax deduction from donating the conservation easement has become an important byproduct to favor the wealthy. Consequently, more stringent appraisal rules and review process are called for (Small 1999, Small 2003). The future study on this issue may require more information concerning the outcomes of conservation easements on tax revenues and benefit distributions.

Conservation easements are still the most popular tool and growing fast. Like any other conservation tool, it has its own pros and cons. The widespread acceptance of this tool reflects somewhat its creativity and efficacy (compared with regulation and management of the government). The tool leaves the decision to the private sector. A deeper investigation and perspective of the mechanism and rationale of this tool may lead to better gains of the whole society.

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