Land Trusts Policy:
Is It Socially Optimal?

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Abstract

The impressive growth in land conservation by the private sector, primarily by land trusts, has resulted from a number of policies that subsidize such activity. These include federal income and estate tax benefits, and state income and property tax benefits. We model the equilibrium in the private land conservation market and the social welfare maximization problem of the government. We estimate the supply of conservation easements in the San Francisco Bay Area counties. Our results show that conservation easements are own price inelastic, but nevertheless are sensitive to the opportunity cost of land. For a simultaneous equation model, the spillover effect of easements on the value of other properties is found to be positive and significant. A possible equity implication is the barriers to entry facing low-income individuals in the housing market.

Introduction

Land conservation by the private sector has reached more than 37 million acres in 2005, an area roughly equivalent to that of the state of Illinois, along with a growth in the number of land trusts operating in the U.S. to nearly 1,700 (Land Trust Alliance 2005). Increasing awareness of the environment is one explanation for the phenomenon; but this proliferation stems also to a great extent from financial incentives given by federal and state governments to landowners that sell or donate their property to land trusts, and to those who sell or donate conservation easements on their land. A conservation easement is a contract by which the owner of the land forgoes the option to develop his land completely or almost completely, according to the definition in the contract, in perpetuity. The incentives for selling or donating easements include income tax deductions and credits, property tax reductions and estate tax reductions. The surge in the popularity of easements as a land conservation tool can be seen in Table 1.

The positive externalities created by open space and limitations on development justify the existence of the tax incentives for land conservation. But in some cases, the mirror image of the tax incentives can be an erosion of the property tax base, affecting the budgets of government entities such as counties, and potentially also those of states. Another troubling aspect is that the resulting pattern of land acquisition may be suboptimal given sufficient weight to the welfare of different sectors in the economy, such as low-income households and home-renters. This can happen when land supply is reduced in proximity to urban areas with high population growth, and housing prices rise such that these lower-income people are excluded from the market.

The fact that land conservation easements are perpetual aggravates the problem, as it introduces inflexibility to the market. These possible adverse consequences require a careful design of the optimal tax incentives for land conservation, and possibly closer monitoring by government agencies of land trusts activity.

Most academic work on land trusts was done by conservation scientists and law scholars. Raymond and Fairfax (2002) wrote one of the most critical articles on land conservation by land trusts. The authors describe how control over public funds that acquire land is in private hands with special interests. Addressing the double effect of reduced tax and increased value of a property that easements often have, Raymond and Fairfax (2002) write: ``The equity implications of this kind of outcome are troubling, to say the least, given the involvement of public funds in financing the original transactions". Raymond and Fairfax also point to the lack of accountability and public participation in the decision-making process by land trusts. Finally, they highlight the fact that in many cases the public is denied access to land under conservation easements; in 2002, less than 10% of the land under easement in the Bay Area was open the public.

McLaughlin (2004) was motivated by *The Washington Post* articles from 2003 about the Nature Conservancy and the ensuing Senate investigation of ``questionable conservation easements." Her recommendations for attorneys involved in conservation easement deals stress the importance of being able to show the proposed easement has real conservation value, and the necessity of a reliable appraisal of the property in question. Recognizing the limitations of the current concept of perpetual conservation easement, McLaughlin (2005) argues that courts of law should allow a redefinition and modification of an easement when the original conservation purpose is no longer possible.

Elmendorf (2004) looks at the interaction between land trusts and landowners from a transaction costs perspective and suggests strategies for optimal contracts of land conservation. He assumes that the land trust is a completely separate entity from the landowner making asymmetric information a problem. This way of modeling the interaction is less relevant when discussing regional and local land trust, as landowners are often involved in the decision-making process of the land trust.

Sundberg and Dye (2006) have listed and analyzed the tax incentives given to conservation easement donors in the different states. Their conclusion is that the existing incentives schedule encourages landowners with larger tax liabilities to donate easements and does not give equal benefits to those with smaller liabilities but possibly higher environmental value of land. They emphasize the importance of better assessment of the public benefit created by easements.

King and Anderson (2004) used tax rates as an indicator of the interaction between land trust activity and the rest of the community. They examined the short-term and long-term effects of an increase in conservation easements on property tax rates in 29 Vermont towns, and found it to be positive in the short-run, but neutral or negative in the long-run. In Vermont, property taxes are determined annually by the municipalities. In states such as California, where property taxes are determined by the voters, the effect of an increase in the number of easements on town budgets is expected to be more pronounced. In another paper, Anderson and King (2004) model the decision-making process by which landowners decide whether or not to donate a conservation easement on their land as a non-cooperative game, and test their model in a laboratory experiment. The results of the experiment show that landowners do not base their decisions to conserve land on the social value of land, but rather on the private value they expect to obtain.

The public economics literature has not yet addressed the question of taxation in the context of land conservation, but examined taxation in the presence of externalities (Sandmo 1975) and how charitable contributions should be taxed when contributions create externalities (Saez 2004). The optimal tax rate will have a component equal to the externality created (a Pigouvian component) and a commodity tax component. If the government cares about distribution and not only about the efficiency of the tax schedule, then a high tax rate is better when the source of the externality is the choices of the high-income sector and those suffering from the externality are in the low-income sector (Sandmo 1975). Saez (2004) shows that contributions to private supply of public goods should be taxed more heavily when the contributors are the more financially well-off.

Lopez et al. (1994) examined the optimal land allocation in a model with two sectors: urban and agricultural, where agricultural land is assumed to generate a positive externality. Their model and estimation results suggest that the quantity of agricultural land is below the socially optimal level. Their conclusion is that policies such as subsidies to agriculture could help to create a more optimal allocation of land, but in their analysis they do not take into account the possibility that the private sector will act with the same purpose of increasing amenity values as land trusts do.

The question of optimal land acquisition with heterogeneity in the environmental amenities was addressed by Babcock et al. (1997) and Wu et al. (2001). They considered the benefits of environmental targeting in the purchase of agricultural land for conservation, and derived an analytical solution of the problem. An extension of their research is the derivation of a political-economic model of land conservation, where the interaction between different interest groups could lead to a different equilibrium.

More recently, Zilberman et al. (2006) and Lipper at al. (2006) investigated the topic of payments for environmental services in the context of economic development. They model the effect of programs similar to the Conservation Reserve Program on third parties such as urban consumers and landless workers in a general equilibrium framework. Land trusts activities are also considered a form of payment for environmental services. In the U.S., the effects on the labor market will be hard to estimate, thus this study will look at third-party effects in the housing market and local public finance.

The purpose of this paper is to analyze the implications of the existing policy toward land conservation on the resulting pricing of open space and its quantity, along with its distribution. We construct a model to explain what determines the price and quantity of conservation easements, and what optimization problem the policymaker has to solve to set its policy variables. The predictions of the model will then be empirically tested using data from the San Francisco Bay Area.

Theoretical model

The starting point is an economy where distortionary taxes exist on goods. Open space is a good that is chosen directly by individuals for consumption and also has an external effect. On the demand side there are *N* consumers in the economy with the following preferences:

(1) $u^n = u(x^n, h^n, l^n, OS)$

where x^n is composite good consumption by the individual; h^n is housing consumption; l^n is a conservation easement held by the individual; $OS = \sum_{n \in N} l^n + OS_G$ is the (positive) externality created by open space as public good, composed of conservation easements and public land, OS_G. Individuals are heterogeneous in income.

Individuals maximize their utility subject to a budget constraint:

(2) $y^n(1-\tau_I) = x^n + p_H(1+\tau_H)h^n + p_L(1+\tau_L)l^n$

where income y^n is given exogenously; p_H is the price of housing; p_L is the price of open space land; $0 \le \tau_I \le 1$ is the income tax rate; $0 \le \tau_H \le 1$ is the housing property tax rate; $0 \le \tau_L \le 1$ is the open space property tax rate; the price of the composite good is normalized to 1.

Utility maximization subject to the budget constraint gives the corresponding optimal levels of consumption

(3) $x^n = x^n(p_H(1+\tau_H), p_L(1+\tau_L), y^n(1-\tau_I), OS_G)$

(4) $h^n = h^n(p_H(1+\tau_H), p_L(1+\tau_L), y^n(1-\tau_I), OS_G)$, and

(5) $l^n = l^n(p_H(1+\tau_H), p_L(1+\tau_L), y^n(1-\tau_I), OS_G)$.

For many individuals $l^n = 0$, i.e. they do not own any land beyond what is part of their housing consumption. Adding over all individuals we can get the aggregate demand for private open space:

(6) $\sum_{n \in N} l^n(p_H(1+\tau_H), p_L(1+\tau_L), y^n(1-\tau_I), OS_G)$.

On the supply side there are K landowners, mostly farmers and ranchers, maximizing the profits from their land subject to their land constraint:

(7) $\pi_k = pq(l^k) - \tau_L l^k + sl^k + p_H h^k, \qquad k = 1,\ldots,K$

subject to $L^k = l^k + h^k$.

where p is the price of the agricultural product $q()$; l^k is amount of land left as open space by the landowner, and h^k is the amount of land sold by the landowner to developers. s is the subsidy per acre paid to the landowner for keeping his open space in an easement. Solving (7) gives the supply of open space land by the landowner:

(8) $l^k = l^k(p_H, \tau_L, p, s, L^k)$.

Adding this over all landowners gives the aggregate supply of private open space:

(9) $\sum_{k \in K} l^k (p_H, \tau_L, p, s, L^k)$.

In equilibrium, the amount of private open space demanded and the amount supplied are equal:

(10) $\sum_{n \in N} l^{0n} (p_H (1+\tau_H), p_L (1+\tau_L), y^n (1-\tau_I), OS_G) = \sum_{k \in K} l^k (p_H, \tau_L, p, s, L^k)$;

price and quantity of open space are jointly determined. Housing price and publicly provided open space are exogenous in this equilibrium.

Social Planner

We want to consider how the government sets its policy with respect to open space conservation, i.e. the settings on the taxes and the open space subsidy instruments. From the individual's problem we have the indirect utility function

(11) $v^n (p_H (1+\tau_H), p_L (1+\tau_L), y^n (1-\tau_I), OS)$.

The government maximizes the sum of weighted individual indirect utilities and the sum of weighted profits of the landowners subject to a revenue constraint:

(12) $\max_{\tau_H, \tau_L, \tau_I, s} \sum_{n \in N} \mu^n v^n (p_H (1+\tau_H), p_L (1+\tau_L), y^n (1-\tau_I), OS) + \sum_{k \in K} \pi^k (p_H, \tau_L, p, s, L^k)$

s.t. $\sum_{n \in N} (\tau_I y^n + p_H \tau_H h^{0n} + p_L \tau_L l^{0n}) = NR + s p_L \sum_{k \in K} l^k$

where μ^n is the weight associated with individual *n*; μ^k is the weight associated with landowner *k*; and *R* is a (predetermined) lumpsum payment to individuals[1].

The first order conditions for this maximization problem will yield the optimal taxation rules. We will not develop them fully in this paper, but we will mention that the optimal tax on private open space will have both a commodity tax component and an additive externality term,

[1] *R* can be thought of as the cost of government provided services and goods per capita.

similar to the one found by Sandmo (1975) and Saez (2004). The government has to set the subsidy to equal this externality term that is unaccounted for by market transactions. But the model also shows that a subsidy is not enough to ensure equity in the distribution of open space benefits. The distributional preferences of the government, represented by the weights μ^n and μ^k, will matter in the setting of the policy instruments.

Lower income individuals might not enjoy those benefits if the demand for private open space is more concentrated in the higher end of the income distribution, and if there is some degree of geographical separation between low income and high income housing. Obviously the amount of publicly provided open space OS_G can be made a decision variable for the government. As a result, the government can control the distribution of open space benefits across geographical locations and socio-economic sectors.

Data

The data for the empirical analysis comes from three sources: Land conservation data were obtained from the Bay Area Open Space Council, an umbrella organization of all land conservation agencies and non-profit organizations in the region. The data cover the following counties: Alameda, Contra Costa, Marin, Napa, San Mateo, Solano, and Sonoma. The total area of the region is 3,600,000 acres, of which 900,000 are under conservation by various agencies and organizations. Of those 900,000, approximately 140,000 are in conservation easements. The data contain the geographical location of land parcels under conservation along with various characteristics, such as ownership type (easement or fee), access to the public, and purpose of conservation. Figure 1 shows a map of the region and the conservation easements in it. The organizations were also contacted individually to obtain the dates of acquisition for the parcels.

A commercial service, parcelquest.com, provided real-estate data: land and improvements value, property taxes, and other property characteristics, such as area, number of buildings, number of bedrooms, whether there is a pool on the property, and whether the homeowner lives in the property. A crucial part of the property data is the last date of sale of the property. This is important because the values reported by the assessors' offices in California do not reflect the current market valuation, but rather the market valuation at the date the property last changed hands. This can be as far as 1975, the base year for Proposition 13, the California legislation that establishes this system. Therefore, we have constructed an index of land values with 1995 as the base year. The evolution of land prices can be seen in Figure 2. Land values were then adjusted with this index. Demographic and socio-economic data is from the 2000 U.S. Census. Summary statistics are given in Table 2.

There are 405 conservation easements in the dataset and 431 other parcels. The mean (adjusted) land value per acre for the easements is $5,641, and for the other parcels it is $93,517. The difference is statistically significant. The counties of Sonoma, Marin, Napa and Alameda are those with the greatest number of easements in the sample (and also in the entire Bay Area population).

Empirical Model

In our empirical analysis, we will proceed to estimate the supply equation for conservation easements. The estimated equation is:

$$(13)\quad Area_i = \beta_0 + \beta_1 Land\_value_i + \beta_2 Block\_value_i + \beta_4 Alameda_i$$

$$+ \beta_5 Marin_i + \beta_6 Napa_i + \beta_7 Sonoma_i + \beta_8 San\_Mateo_i + \varepsilon_i$$

for all parcels with conservation easements. $Land\_value_i$ is land value per acre of land, and

$Block\_value_i$ is the price per acre of land without easements in the Census block. We measure the effect of publicly provided open space and of agricultural activity with the county dummy variables.

Since the quantity of land in easements and the price of that land are jointly determined, we need to instrument for the price. We estimate the following reduced form equation:

$$(14)\ Land\_Value_i = \alpha_0 + \alpha_1 Block\_value_i + \alpha_2 Med\_income_i + \alpha_3 Improvement\_Value_i$$

$$+ \alpha_4 Pop\_Dens_i + \alpha_5 Renters_i + \alpha_6 Alameda_i + \alpha_7 Marin_i$$

$$+ \alpha_8 Napa_i + \alpha_9 Sonoma_i + \alpha_{10} San\_Mateo_i\ .$$

where the additional exogenous variables are median income in the easement's census block, the value of the improvements on the property, the share of renters in the surroundings of the easement, and population density. The order condition for identification is met here, as we have two endogenous variables in the supply equation and four exogenous variables outside the equation.

An important question when evaluating the consequences of land conservation is whether there are any spillover effects on other parcels, i.e. does the existence of easements raise or lower the value of other properties. We would expect the answer to this question to be "raise" if individuals value the fact that there is perpetual open space near their residence.

For this purpose we will estimate a price equation for non-easement parcels, having as explanatory variables the share of land in conservation easements in the surroundings of each parcel and the area of the parcel:

$$(15)\ Land\_Value_i = \gamma_1 + \gamma_2 Easements\_Share_i + \gamma_3 Area_i + v_i$$

Since we again have the issue of simultaneity between price and quantity, we will instrument for the area of the parcel in a similar way to that in (13).

Results

The results of the estimation of (13), the reduced form equation of conservation easement land, are given in Table 3. The coefficient on the easement's own price is insignificant, meaning that easement supply is price inelastic. This result is surprising if we think about the market for conservation easements as we think about any other competitive land market. Landowners who decide to have easements on their land may do so for many reasons that are hard to model in a conventional demand and supply framework. They often care about the fact that the land will remain agricultural land, even if the profitability from doing so is not high. That can yield an inelastic supply of land, since they will donate or sell the land to a land conservation organization almost regardless of the subsidy involved.

The significant coefficients are those of the land value of neighboring non-easement parcels, and the dummy variable for Marin County. The opportunity cost of having land in a conservation easement is its use as land for housing or highly profitable agriculture such as vineyards. That is why we see a negative coefficient on that variable. The value of -0.001 means that for every $1,000 increase in the price of land, there is a 1 acre decrease in the size of an easement.

As for Marin County, the positive coefficient is a result of the nature of conservation easements in that county: they are mostly held by the Marin Agricultural Land Trust, an organization that conserves mainly large parcels of rangeland. The average size of a conservation easement in Marin is double that size in the rest of the counties.

The results of the spillover effect equation are in par with our expectations, as can be seen in Table 4. The spillover effect is positive and significant. A 1% increase in the share of easements in the surroundings of a parcel leads to an increase of about $3,300 in land value per acre. Since the average share of easements in our sample is 10%, this means an increase of about $33,000 in the price per acre as a result of land conservation.

Conclusions

Land trusts have not been considered so far as an important factor affecting regional land markets. That is both because in many areas their level of activity is not high, and also because land conservation is regarded as a win-win situation: landowners get some compensation for not developing their land, and the public gets open space benefits. But another possible result is that of land supply being reduced in certain areas, and prices increasing so that they price some sectors of the population out of the market.

We have outlined a framework for the analysis of this problem, looking at both the demand and the supply of conservation easements by landowners, and at the social welfare maximization problem of the government.

An estimation of the supply of conservation easements failed to find a price response of the quantity supplied to the price of the land. We explain that by the fact that there are some "non-economic" motivations for landowners that agree to sell or donate conservation easements. That adds a level of complexity to the problem, but also a level of caution to policymakers: these private motivations can result in conservation easements that have little public benefit value, but nonetheless get the tax benefits as if they have greater value.

The estimation of the "spillover effect" equation has shown that easements have an effect on the price of other parcels in the market, and then they could have possible equity implications: if easements affect land markets both by reducing supply and by raising prices because of their open space benefits, then lower income population might find it harder to buy a residence. This has to be taken into account when designing the policy instruments for land conservation by the private sector.

Our theoretical framework shows where we think our future research on the subject is headed, looking at the public finance part of land trust activity and conservation easements. By estimating the supply and demand parameters we will be able to simulate what the optimal tax and subsidy for private open space should be, in a way that minimizes adverse efficiency and equity implications.

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Table 1: Local, State and Regional Land Trusts Total Acres under Easement by Region, 2005

Region	Acres under Easement	% Increase '00 to '05
Northeast	2,310,487	203%
Pacific	427,623	167%
Mid-Atlantic	726,379	79%
Southwest	1,196,987	195%
Northwest	893,520	74%
Southeast	485,638	165%
Midwest	205,335	145%
Total	6,245,969	148%

Source: Land Trust Alliance Census 2006

Table 2: Summary Statistics for the Parcels in the Sample

Variable	Mean	S.D.	Min.	Max.
In Easement	0.49			
Property Values:				
Total Value/Acre	119677.80	255367.40	0	3471000.00
Land Value/Acre	50786.79	94399.25	0	1041300.00
Improvement Value	459052.30	5546761.00	0	159000000.00
Property Characteristics:				
Area	132.29	471.59	0.05	10670.52
Number of Buildings	0.79	0.78	0	8.00
Number of Rooms	1.84	1.94	0	13.00
Pool	0.05	0.22	0	1.00
Homeowner Exemption	0.38	0.48	0	1.00
Census Data (Blocks):				
Population Density	0.38	1.06	0.01	14.92
Share of Urban	0.34	0.40	0	1.00
Share of Renters	0.29	0.15	0	0.61
Share of Farms	0.09	0.10	0	0.34
Median Income	71684.38	27312.04	35083	196871
Shares of Counties:				
Alameda	0.15			
Contra Costa	0.03			
Marin	0.19			
Napa	0.17			
San Mateo	0.07			
Solano	0.03			
Sonoma	0.36			

N=837

Table3: IV Regression of Land Area for Easements.

Dependent Variable: **Area**

Variable	Coefficient	S.E.	*t*	*Pr>|t|*
Constant	230.5128	56.45602	4.08	0.0000
Own Land Value/Acre	-0.00227	0.0041	-0.55	0.5810
Land Value/Acre of non-easements	-0.001	0.000299	-3.35	0.0010
Alameda	-31.7445	80.51181	-0.39	0.6940
Marin	302.3711	93.22788	3.24	0.0010
Napa	19.21975	81.44522	0.24	0.8140
San Mateo	146.2239	131.2811	1.11	0.2660
Sonoma	165.3339	120.4136	1.37	0.1710

N=407
F=11.37
Pr.>F=0.00
R-Squared=0.0493

Table 4: IV Regression of Spillover Effect of Easements.

Dependent Variable: **Land Value/Acre**

Variable	Coefficient	S.E.	*t*	*Pr>|t|*
Constant	155854.5	127801.1	1.22	0.223
Own Area	-2860.99	2079.336	-1.38	0.17
Share of Easements	330309.2	149655.3	2.21	0.028

N=430
F=2.61
Pr.>F=0.00
R-Squared=0.1841

Figure 1: Open Space in the San Francisco Bay Area

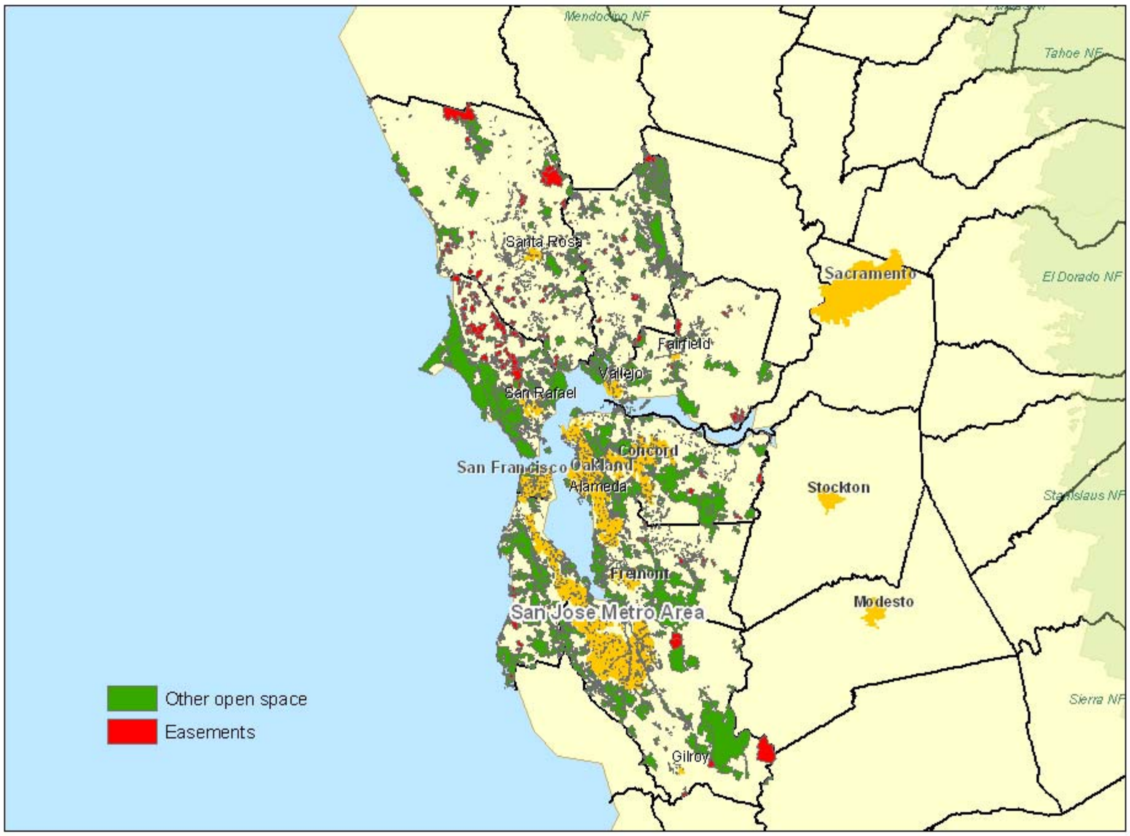

Figure 2: The Evolution of Land Prices