Tax Incentives and the Price of Conservation

Dominic P. Parker, Walter N. Thurman

Abstract: We study the role of tax incentives in promoting a fast-growing and novel type of conservation: voluntary, permanent restrictions on private land use through conservation easements. In the United States, easements represent the largest charitable gift on a per-donation basis, but skeptics wonder if their tax preference merely subsidizes wealthy landowners rather than inducing conservation. We incorporate federal and state income tax codes into a calculator to quantify the after-tax donation price and demonstrate its sensitivity to landowner income and state and federal policies. Using a 1987–2012 panel, we measure the response of state-level easements to the price. Our large elasticity estimates, spanning −2.4 to −6.1, indicate that tax incentives induce conservation and do not merely subsidize it. We find no evidence that generous tax benefits have caused less strategic patterns of land conservation.

JEL Codes: H31, H41, L31, Q24

Keywords: Charitable donations, Conservation easements, Land trusts, Land use, Private provision of public goods, Tax incentives

THE CHARITABLE DONATION INCENTIVE embedded in the income tax codes of many countries is controversial, and the extent to which it impacts charitable giving is the subject of debate. According to its proponents, the deduction augments giving to nonprofits that provide public goods in areas of environment, health, and the arts.

Dominic P. Parker (corresponding author) is at the University of Wisconsin–Madison (dominic.parker@wisc.edu). Walter N. Thurman is at North Carolina State University (wthurman@ncsu.edu). We gratefully acknowledge the advice of Brent Stewart, Guido van der Hoeven, and Phil Harris, which improved our understanding of the tax code. We thank Dylan Brewer and Alexey Kalinin for compiling the tax code and easement holdings data sets. For comments on earlier drafts, we thank anonymous referees, participants at seminars hosted by the University of Wisconsin, and the annual meeting of the Agricultural and Applied Economics Association. Parker gratefully acknowledges funding from a USDA National Institute of Food and Agriculture, Hatch project no. 231919, and from an August 2014 Lone Mountain Fellowship at the Property and Environment Research Center. Thurman gratefully acknowledges the support of the North Carolina Agricultural Research Service.

Received May 6, 2016; Accepted October 10, 2017; Published online February 6, 2018.

JAERE, volume 5, number 2. 2333-5955/2018/0502-0002$10.00 http://dx.doi.org/10.1086/695615

Critics oppose the substantial subsidies to wealthy donors and doubt that tax considerations actually drive charitable giving.

Economists offer findings relevant to the debate, estimating the responsiveness of giving to changes in the after-tax "price" of donating, often specified as one minus the marginal income tax rate. Most studies suggest that donors are responsive to tax benefits, with price elasticities usually varying from around −0.5 to −2.0.[1] Elasticities are important because, when they are large, tax policy induces private provision of public goods at less than a dollar-for-dollar cost, perhaps by leveraging the "warm glow" incentive to donate (Andreoni 1990; Kotchen 2006).

In this paper, we study a prominent type of charitable donation—the conservation easement—for which tax preference is controversial (Bray 2010; Eagle 2011; Looney 2017). Easements are a private and voluntary form of land use zoning. They are legally binding agreements through which landowners give up rights to subdivide and develop rural land but retain rights to farm.[2] Through its support of easements, US federal and state tax codes encourage "dead hand control" of land because they require restrictions to be permanent and, unlike other forms of donation, not subject to reversal (Mahoney 2002; McLaughlin 2005). Supporters view the policies as necessary for protecting valuable natural resources, but critics assert that special tax treatment favors wealthy landowners and may not induce conservation. Critics also note that tax advantaging easements runs counter to Internal Revenue Service policy that otherwise denies deductions for gifts of partial interests in property due to concerns about accurately valuing such interests (Halperin 2011). The exception is made in spite of concerns about the ability of easement holders—small organizations known as land trusts—to enforce perpetual agreements.

The study of tax policy here is important for several reasons. First, on a per-donation basis, conservation easements in the United States dwarf in value every other form of charitable giving: art, real estate, and money.[3] Second, while easements rep-

1. Studies estimating giving responses, measured in dollars, to persistent changes in the tax code include Randolph (1995) (an elasticity of about −0.5), Auten et al. (2002) (a range from −0.4 to −1.26), Bakija et al. (2003) (an elasticity of about −2.0), and Bakija and Heim (2011) (an elasticity of about −1). More recent estimates are smaller and highlight debate about estimation techniques (Backus and Grant 2016; Hungerman and Ottoni-Wilhelm 2016).

2. Conservation easements typically regulate mining, forestry, and agricultural practices. For in-depth legal descriptions, see Korngold (1984) and Dana and Ramsey (1989). For descriptions of easement terms, see Boyd et al. (2000), Parker (2004), and Rissman et al. (2007). Conservation easements were pioneered in the United States but their use has been expanding internationally, for example, to Canada (Lawley and Towe 2014; Lawley and Yang 2015).

3. During the 2000s, the average value of a donated conservation easement was $491,000 compared to $163,000 for land, $45,000 for stocks and other financial gifts, $37,000 for intellectual property, and $7,000 for art (Eagle 2011). In aggregate, easements represented 3.4% of

Table 1. Comparison of Government and Land Trust Holdings

	1990 Acres	2010 Acres	Change 1990–2010	% Change 1990–2010
Four federal land agencies:				
Bureau of Land Management	168,223,327	171,186,890	2,963,563	1.76
US Forest Service	165,790,139	167,598,134	1,807,995	1.09
US Park Service	20,179,876	24,380,375	4,200,499	20.82
US Fish and Wildlife Service	4,697,914	4,882,153	184,239	3.92
Federal programs:				
Conservation reserve	32,522,280	31,298,245	−1,224,035	−3.76
Wetland reserve	0	2,311,702	2,311,702	NA
State parks:*	7,895,296	10,526,759	2,631,463	33.33
Land trusts:				
Outright ownership	2,165,041	7,681,198	5,516,157	254.8
Conservation easements	793,137	13,392,500	12,599,363	1588.6

Note. The federal land data come from Payment in Lieu of Taxes (PILT) records of the US Department of the Interior. The federal land program data come from the US Department of Agriculture. The state parks data come from the US Census. The conservation easement data come from files sent to the authors from The Nature Conservancy and data from the periodic Land Trust Alliance Censuses. All comparisons exclude land held in Alaska.

* Denotes the data are for 2007 rather than 2010.

resent the fastest growing form of land conservation in the United States (see table 1), the impact of tax incentives on growth has not yet been comprehensively quantified. Third, tax benefits for easement donations are growing: federal incentives were augmented in 2006 and, since 2000, many states have created tax credits. Fourth, the permanence of easements means that patterns of conservation induced by even temporary tax incentives will have an enduring effect on future land use. Fifth, some have worried that tax-driven easement donations lead to the wrong lands being conserved, because land trusts may respond to ad hoc donation opportunities rather than adhering to planning processes (Merenlender et al. 2004; Parker 2005; Pidot 2005; Wolf 2012).

Our contribution can be summarized along three dimensions. First, we develop a theoretical expression for the after-tax price of permanent land conservation. The expression highlights three channels through which tax policy may affect conservation decisions. One is a nonmarket consumption shield, analogous to the subsidy to leisure under an income tax, which reflects how the price of permanently providing nonmarket conservation amenities is inversely related to the tax rate on income from devel-

noncash charitable contributions over 2003–12 ($13.7 billion out of $408 billion). See www.irs.gov/uac/SOI-Tax-Stats-Special-Studies-on-Individual-Tax-Return-Data#noncash.

oped land (e.g., rental income from housing). Another channel is the conservation policy incentive. It arises from federal and state deductibility of easement donations and from targeted tax credits at the state level. Through this channel, the price falls not only with increases in tax rates and credits but also with increases in the percentage of the gift eligible for deductions and credits.[4]

Our second contribution is to quantify the conservation policy incentive for different landowners in different states by constructing a tax calculator, spanning 1987–2012.[5] Conditional on a taxpayer's income and the value of an easement donation the calculator generates an estimate of the after-tax price of conservation. This price incorporates federal and state tax rates, rules about charitable deductions, and, importantly, state tax-credit programs. It also accounts for the dynamic effects of carryover provisions and annual income limits on easement deductions. The resulting price varies sharply over time and across states. For example, for a landowner with annual income of $100,000, a donation valued at $500,000, and no exposure to capital gains taxation absent a donation, the price ranges from a low of $0.51 per donated dollar to a high of $0.95. The price ranges from $0.35 to $0.72 if the landowner's income is $1 million rather than $100,000. If a landowner earning $100,000 would otherwise have to claim a long-term capital gain of $500,000, the price would range from $0.31 to $0.79.

Our third contribution is to measure the responsiveness of donations to price. We develop state-level panels of easement holdings by land trusts over 1987–2012 and find large responses to changes in the donation price. The percentage change in easement holdings corresponding to a 1% change in price range from around −2.4 to −6.1. The elasticities are large and support the previously untested assertion that tax incentives have driven land trust conservation.[6] For example, they imply that federal tax

4. We presume that this incentive is salient, as the term is used by Chetty et al. (2009) and Chetty and Saez (2013), because information about tax implications is readily available to landowners.

5. Our calculator is the first to quantify tax savings from easement donations over a long panel, but Sundberg and Dye (2006) estimate tax prices for donations based on cross-sectional scenarios. Other scholars have developed calculators that estimate the price of charitable giving in general (Feenberg and Coutts 1993; Bakija 2009; Bakija and Heim 2011). The general calculators do not consider tax code features unique to easement donations.

6. Two recent unpublished studies examine the effects of tax incentives on land conservation, both viewing state tax incentives as homogeneous and binary treatments. Soppelsa (2015) finds that counties in treated states have a higher flow of land parcels into protected status. Suter et al. (2014) also treat tax incentives as binary treatment and investigate the effect of such treatment on land trusts, as opposed to donors. They find that trusts in states with tax credits are more likely to specialize in holding all-donated easement portfolios of protected land, with no purchased easements. Sundberg (2011) uses a binary variable to identify states with tax-credit programs, and he finds increases in easements in those states during the mid-2000s.

code changes in 2006, which lowered the donation price by 6.6%, stimulated an increase of 40.1% in the annual flow of easement acres.

We also investigate the impact of tax incentives on the precision and quality of lands conserved. We find suggestive evidence that land trusts accept donations that they would not choose to purchase. However, we find no evidence that easement donations induced by lower after-tax prices are inferior in quality to other easement donations.

1. A THEORY OF THE SUPPLY OF OPEN SPACE AND THE PRICE OF CONSERVATION

The decision to donate an easement is a decision to reallocate an asset portfolio—between developable and permanently conserved classes—in order to secure a preferred consumption stream. The portfolio adjustment results in a change in the supply of open space amenities, which are managed by the land trust accepting the easement. We develop a theory of the decision that focuses on the tax-influenced price of conservation, which provides the conceptual basis for the quantitative output of our tax calculator.

1.1. The Price of Conservation as Influenced by the Tax Code

Consider an agricultural landowner, shown in figure 1, who derives utility from market consumption W (wealth) and permanent land conservation C.[7] There are no taxes. The landowner's single asset is land, which generates an annual farm income of I. If developed and converted to housing, the land would generate an annual stream of rental income of $I + D$.

The landowner has a once-and-for-all opportunity to restrict development on a portion of the land by placing on it a perpetual conservation easement. The conserved portion is farmed or sold to someone who is allowed only to farm the parcel. The nonconserved land is sold to another party who develops it to earn its housing potential. We take the quantity of C consumed by the landowner to be the present value of the development income streams extinguished by the easement, a market measure of the pressure to develop.

The landowner determines the fraction α of land to conserve, and thereby the allocation of assets between market consumption and conservation. Given α, market consumption is the present value of income generated by the property. Land that continues to be farmed generates annual income of αI, with a present value of $\alpha I/r$, where

7. Conservation here stands for any use of land that does not require development, e.g., agriculture and forestry. Utility is derived from permanence; the landowner is presumed to want future generations to enjoy the land in its present, undeveloped state.

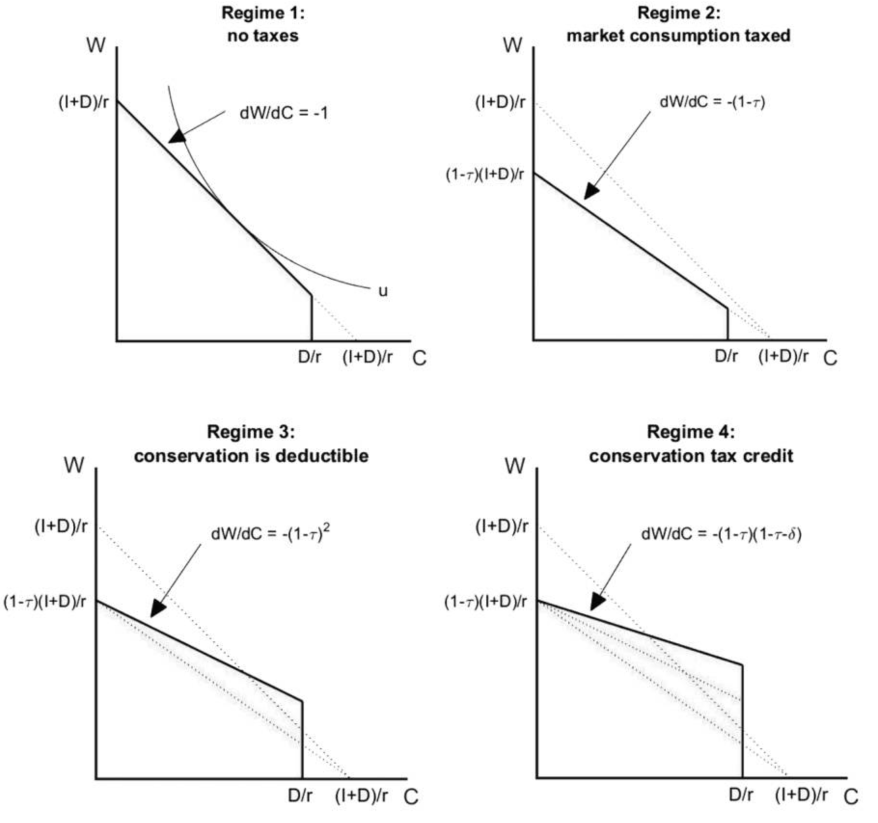

Figure 1. Budget constraints of landowner under four tax regimes

r is the interest rate. Land that is developed earns annual income of $(1 - \alpha)(I + D)$, with a present value of $(1 - \alpha)(I + D)/r$. Total market wealth is given by

$$\begin{aligned} W &= PV(\textit{farm income}) + PV(\textit{development income}) \\ &= \frac{\alpha I}{r} + \frac{(1-\alpha)(I+D)}{r} = \frac{I+D}{r} - \frac{\alpha D}{r} = \frac{I+D}{r} - C, \end{aligned} \tag{1}$$

where the value of conservation is, by definition, $C = \alpha D/r$, the present value of development rents withheld from the market. A rearrangement of (1) yields

$$W + C = \frac{I+D}{r}, \text{ for } C \leq \frac{D}{r}. \tag{2}$$

Expression (2) is the budget constraint for the landowner's choice between market consumption and conservation. The inequality represents the fact that the quantity of conservation is limited by the development potential of the property. This concept of conservation implies that because D increases with the demand for housing, extinguishing development rights yields higher utility in locales where development is most imminent. As indicated in (2) and in regime 1 in figure 1, the trade-off of wealth for conservation is one for one. The price of conservation in terms of forgone market consumption is $P_C = 1$.

Regime 2 introduces a constant, proportional tax on income at the rate τ. Taxable income is generated both by farm earnings and rental income and, for now, we ignore any taxation on capital gains accruing from appreciation in land value. Conservation is shielded from income tax here because it represents potential market income—streams of taxable rental payments—permanently forgone. The situation is analogous to the implicit tax subsidy for leisure in models of time allocation.

With α share of land put under an easement and farmed, annual after-tax income now is $\alpha(1-\tau)I$ and the present value of the perpetuity of farm income is $\alpha(1-\tau)I/r$. The present value of the perpetuity of income from developed land (equivalently, the sales price of the land) is $(1-\alpha)(1-\tau)(I+D)/r$. The sum of the two values is wealth to be spent on market goods:

$$
\begin{aligned}
W &= PV(\textit{farm income}) + PV(\textit{development income}) \\
&= \frac{\alpha(1-\tau)I}{r} + \frac{(1-\alpha)(1-\tau)(I+D)}{r} = \frac{(1-\tau)(I+D)}{r} - \alpha(1-\tau)\frac{D}{r}.
\end{aligned} \tag{3}
$$

Substituting the definition of conservation, $C = \alpha D/r$, into (3) and rearranging yields

$$
W + (1-\tau)C = \frac{(1-\tau)(I+D)}{r}, \text{ for } C \leq \frac{D}{r}. \tag{4}
$$

Equation (4) displays the income effect of the tax on the right-hand side and the change in the relative price of conservation on the left. The relative price is now $P_C = (1-\tau)$. Figure 1 is drawn with $\tau = 0.3$, implying that $P_C = 0.7$. The indifference curve reflecting landowner preferences is omitted in the second panel and beyond in order to focus on changes in the budget constraint and the price.

Regime 3 introduces the deductibility of easements as charitable contributions, a tax advantage beyond the shielding of C consumption from tax. The deduction is based on the assessed value of the easement, which is the difference between the market value of land that can be developed and land that cannot. If the α portion of land remained developable, its sales price would be the present value of after-tax rental income, $\alpha(1-\tau)(I+D)/r$. If the land can only be farmed its value will be $\alpha(1-\tau)I/r$. The difference in value, $\alpha(1-\tau)D/r$, is the assessed easement value. Therefore, with deductibility, the present value of post-tax farm income is

$$PV(\textit{farm income}) = PV(\textit{post tax farm income}) + PV(\textit{tax savings}) = \frac{\alpha(1-\tau)I}{r} + \tau\,\alpha\frac{(1-\tau)D}{r}. \tag{5}$$

The first addend on the right-hand side of (5) is the present value of post-tax income in all years except the first. In the year of the donation, due to the deduction, the farmer enjoys a once-and-for-all benefit equal to the proportional tax rate times the assessed value of development rights, which is the second addend.[8]

The present value of post-tax development income is the same as under regime 2. The sum of the present values of farm and development income represents the present value of the consumption of market goods:

$$\begin{aligned} W &= PV(\textit{farm income}) + PV(\textit{development income}) \\ &= \frac{\alpha(1-\tau)I}{r} + \tau\alpha\frac{(1-\tau)D}{r} + \frac{(1-\alpha)(1-\tau)(I+D)}{r} \\ &= \frac{(1-\tau)(I+D)}{r} - (1-\tau)^2\frac{\alpha D}{r}. \end{aligned} \tag{6}$$

Substituting for the definition of conservation and rearranging yields

$$W + (1-\tau)^2 C = \frac{(1-\tau)(I+D)}{r}, \text{ for } C \le \frac{D}{r}. \tag{7}$$

Comparing the budget constraint in (4) with that in (7) shows the regime 2 to regime 3 reduction in the price from $(1-\tau)$ to $(1-\tau)^2$, reflecting the additional deductibility benefit from creating an easement beyond the shielding of conservation from tax. The reduction in P_C is reflected in the flatter budget line shown in regime 3 of figure 1. The regime 3 price reflects a subtle departure from previous literature, which has considered the price of donating noncash assets to be approximately $(1-\tau)$, due to deductibility of charitable donations, minus additional savings from avoiding taxation on capital gains if the asset has appreciated (Feldstein 1975; Randolph 1995; Barrett et al. 1997; and Bakija and Heim 2011). We arrive at the $(1-\tau)^2$ price not by adding capital gains taxation but by adding tax savings from shielding market income to the saving accrued from tax deductibility. Our price is a departure from previous literature in this respect, and appropriate to easement donations. The logic underlying it does not necessarily extend to noncash assets beyond undeveloped land.[9]

8. The expression for the deductibility benefit in (5) assumes that the deduction benefit is received at the beginning of the first period, while other cash flows are received at the ends of periods.

9. The logic could perhaps be extended to a piece of art, such as a painting, currently in a private home. If the painting is sold to a for-profit museum, it would generate a stream of taxable income implicit in the entrance fees paid by visitors who view the art. Donating the painting

Last, regime 4 introduces a conservation tax credit: donating an easement creates a credit payable against taxes in the amount of δC. The present value of farm income adjusts (5) to reflect the additional one-time tax-credit benefit:

$$PV(\mathit{farm\ income}) = \frac{\alpha(1-\tau)I}{r} + (\tau+\delta)\alpha\frac{(1-\tau)D}{r}. \quad (8)$$

The present value of development income is unchanged from (5).

Using the definition of C, the landowner's budget constraint becomes

$$W + (1-\tau)(1-\tau-\delta)C = \frac{(1-\tau)(I+D)}{r}, \text{ for } C \leq \frac{D}{r}. \quad (9)$$

In regime 4, $P_C = (1-\tau)(1-\tau-\delta)$. With $\tau = 0.30$ and $\delta = 0.25$, the implied price is $P_C = (1 - .30) \times (1 - 0.30 - 0.25) = 0.32$, as illustrated in the figure.

Empirical predictions of the effects of tax code changes follow from the implied changes in the price of conservation and income. Consider the separate effects of changes in τ and δ. An increase in τ rotates the budget line counterclockwise as shown in the move from regime 1 to regime 2 in figure 1. The increase in τ affects C positively through the decrease in P_C and negatively to the extent that the income elasticity of demand for C is positive. An increase in δ, while reducing the price of conservation, has no effect on potential market income $(1-\tau)(I+D)/r$. Increasing δ results in a counterclockwise rotation of the budget constraint as shown in the move from regime 3 to 4, with the fixed point of the rotation on the vertical axis. Thus an increase in δ has an unambiguous positive effect on C through both price and income effects.

1.2. The Role of Tax Rate Differences across Potential Landowners

To this point, we have considered a single tax rate that is relevant to both the farmer and developer. In reality, the US tax code is a progressive system of rates that differ for corporate and noncorporate entities and that allow myriad deductions against taxable income. Here we simply account for the likely possibility that farmers and land developers face different marginal tax rates. Consider the implications of that possibility for the price of conservation.

Let the proportional tax rate facing the farmer be $\tilde{\tau}$ and the tax rate facing developers, and the rate implicit in property and easement valuations, be τ. Then the sales price of the entire farm if allowed to be fully developed would be $(I+D)(1-\tau)/r$. If $(1-\alpha)$ share of the farm is sold, the present value of development income is still given by (6). The expression for farm income is a modification of (8):

to a nonprofit museum saves the owner taxes in two ways: it shields the market value of the painting from taxation implicit in the price that a for-profit bidder would pay, and it lets the owner deduct from his taxable income the appraised value of the painting.

$$PV(\textit{farm income}) = \frac{\alpha(1-\tilde{\tau})I}{r} + (\tilde{\tau}+\delta)\alpha\frac{(1-\tau)D}{r}. \quad (8')$$

The tax rate in (8′) relevant to the farmer is $\tilde{\tau}$ except for the appearance of τ in the assessed value of development rights, $\alpha(1-\tau)D/r$.

As before, adding the present value of development income to (8′) gives market wealth, representing consumption of market goods. Substituting $C = \alpha D/r$ into the sum yields

$$W + P_C C = \frac{(1-\tau)(I+D)}{r}, \quad (10)$$

where

$$P_C = \frac{I}{D}(\tilde{\tau}-\tau) + (1-\tau)(1-\tilde{\tau}-\delta). \quad (11)$$

Now the tax code influences the benefits from donating an easement in two ways. First, $\tilde{\tau}$ is the marginal rate paid by the donor and determines the tax benefit that accrues directly through the reduction in the donor's tax bill via deductibility. Second, τ enters in because the donor enjoys conservation benefits determined by the market's rental rates for land—reflecting development pressure—which are not taxed unless the donor chooses to develop. Development exchanges an untaxed flow for a taxed flow, which is implicitly taxed at rate τ through the land appraisal process. Should τ and $\tilde{\tau}$ differ, the first term in (11) demonstrates the influence on donation incentives that results from channeling the nondevelopment stream of income to the farmer instead of the developer. If $\tilde{\tau}$ exceeds τ, the farmer would pay a higher marginal tax rate on I than would the successful competitive bidder for development rights, thus increasing P_C.

1.3. An Empirical Measure

To summarize the theory, the price of conservation in (11) can be written as

$$\begin{aligned} P_c &= X + Y \cdot Z, \text{ where} \\ X &= \text{the income channeling effect,} \\ Y &= \text{the nonmarket consumption shield, and} \\ Z &= \text{the conservation policy incentive}. \end{aligned} \quad (12)$$

The income channeling effect results from the donation's allocation of income I away from the developer to the landowner, resulting in I being taxed at the landowner's rate. The nonmarket consumption shield acknowledges that withholding land from development shields potential development income from tax. The conservation policy incentive reflects the deductibility of easement donations and targeted tax credits.

Equations (11) and (12) reflect a full accounting of the per-unit opportunity cost of an easement donation. We use (11) as the foundation of our empirical measure but choose to focus on the part of the expression that measures the direct and quantifiable tax benefits from the tax code, the conservation policy incentive. In so doing, our empirical measure ignores the indirect effect of a change in the tax code on the market clearing price of development rights as well as possible income channeling effects. That is, we focus on

$$\tilde{P}_C = (1 - \tilde{\tau} - \delta). \tag{13}$$

We focus on $\tilde{P}_C$ for three reasons. The first is salience. Websites and tax publications provide potential easement donors with rough estimates of the income tax consequences of donations under various scenarios. These estimates focus on the component of P_C that we describe as $\tilde{P}_C$, with adjustments for tax credits, AGI limitations, and carryover provisions. The second reason is related to the first. To account for variation due to the land market's reappraisal of land value as a response to changes in the tax code would require an empirical study of land markets and land appraisal methods that would go far beyond assessing the provisions of the tax code as they relate to easement donations. Such an exercise would necessarily be more speculative than our narrower goal of measuring how changes in the tax code affect the salient portion of the price of conservation. The third reason to focus on $\tilde{P}_C$ is that it is similar to price measures used in the public finance literature on charitable contributions (see Feldstein 1975; Randolph 1995; Barrett et al. 1997; and Bakija and Heim 2011). With some adjustments, this literature typically measures the price of charitable contributions as "one minus the marginal tax rate." We follow the literature by also focusing on this salient component of the price.

1.4. Accounting for Capital Gains Taxation

The empirical measure $\tilde{P}_C$ ignores capital gains tax implications. As discussed in Sundberg and Dye (2006), taxation on the sale of appreciated property can be affected by an easement donation. If one sells property unencumbered by an easement one typically owes federal capital gains tax (currently 15%) on the difference between the property's sale price and the owner's adjusted basis (initial purchase price plus subsequent improvements). If, before selling, one restricts development through an easement, the reduced sales price—with basis apportioned according to the fraction of the sale price to the unencumbered price—reduces the owner's exposure to capital gains tax. Therefore, the capital gains tax can provide an incentive to donate in addition to those provided by the tax on ordinary income.

If the entire farm were sold to a developer, the capital gains would be represented by

$$g = \frac{(I + D)(1 - \tau)}{r} - basis.$$

The tax owed by the farmer would be $\bar{\tau}\lambda g$, where $\bar{\tau}$ is the proportional tax on capital gains and λ the proportion of gain that is taxable.[10] Donation of an easement may eliminate the tax burden, implying that $\bar{\tau}\lambda g/C$ can be subtracted from the price of conservation. Note that this component of the price is a type of nonmarket consumption shield because, by committing to permanent conservation, the land is never sold to a developer and the tax burden is permanently deferred.[11] With capital gains considerations, the full empirical price is

$$\bar{P}_C = \tilde{P}_C - \frac{\bar{\tau}\lambda g}{C} = (1 - \tilde{\tau} - \delta) - \frac{\bar{\tau}\lambda g}{C} \text{ for } g \leq C. \tag{14}$$

This after-tax price is similar to those derived in the public finance literature and is the price we quantify in our empirical work. We do so by constructing a tax calculator that embodies the complex and changing provisions in the federal and state codes over time.

2. THE CONSERVATION INCOME TAX CALCULATOR

In this section, we summarize the incentives provided by federal and state tax codes, describe the tax calculator, and present results on the after-tax price of donating.

2.1. Overview of Federal and State Tax Incentives for Conservation

Federal income tax deductions for easements received statutory authorization in 1976. The tax advantage of a contribution depends on the filer's marginal tax rate, which varies with income in the federal progressive tax structure and has varied over time

10. The size of λ is conditioned by the circumstances and strategies employed by the particular farmer. For example, some exposure to capital gains taxation might be avoided if the farm is the owner's primary residence, and if she can attribute some of the gains to the residence, which is eligible for residence sale exemption (currently at $500,000 for a married couple in the US tax code). There are other means through which taxpayers can avoid exposure to taxation on capital gains (see Bakija and Gentry 2014).

11. Alternatively, the landowner could develop the land, without selling to a developer, thereby deferring capital gains taxation and generating rental income from the development. When the landowner dies, heirs of the appreciated property are typically allowed a step up in basis to the fair market value of the property at the time of inheritance; heirs then pay no capital gains tax upon selling the property immediately. A landowner who follows the strategy of leaving appreciated land to heirs has effectively by-passed the capital gains tax and, therefore, eliminated the capital gains tax benefits that might otherwise flow from the placement of an easement on the land.

due to changes in tax law. In our calculations, higher marginal tax rates (τ) lower the price of conservation. Further, the tax advantage from charitable contributions is, in many instances, limited by a taxpayer's adjusted gross income (AGI) and affected by rules that govern the carryover of unused tax deductions into subsequent tax years. Prior to 2006, federal law capped the deduction a landowner could claim at 30% of his AGI each year for 6 years.

Notably, federal law passed in 2006 increased income tax benefits for easements donated in 2006 through 2012. The new law raised the allowable deduction from 30% of AGI to 50%, and to 100% for qualifying farmers. The law also extended the carry-forward period for a donor from 5 to 15 years. As we see below, these changes have lowered the price of conservation for a subset of taxpayers.

Income tax incentives at the state level have varied significantly across states and across time. Due to the deductibility of state income taxes from federal returns (and the deductibility of federal taxes from some state returns), the federal and state donation incentives interact.

Figure 2 categorizes state income tax structures in 2012 to match the theoretical regimes described in figure 1. Seven states did not tax income, corresponding to regime 1. Eleven states taxed income but did not allow the itemization of charitable deductions, including conservation easements (regime 2). A total of 22 states taxed income and allowed charitable deductions (regime 3). And 11 states offered income tax credits, represented by δ (regime 4). Note that the federal system corresponds to regime 3 and is overlaid on top of the state systems.

The state tax-credit programs (see app. A; apps. A–E available online) allow a taxpayer to take a percentage (from 25% to 100%) of the value of an easement and use it as a dollar-for-dollar credit toward payment of income taxes. Some programs allow both a deduction and a credit for the easement donation. The programs impose various overall limits on deductions, and different rules pertaining to their carryover into future tax years. In four states the credits are transferable, meaning that an AGI-constrained donor can sell credits to a nondonating taxpayer who is not so constrained. This effectively undoes the limitations imposed by percentage-of-AGI rules written into the tax-credit laws, and lowers the price of conservation.

2.2. Constructing the Tax Calculator

Quantifying the net tax advantage from a donation requires a unified calculation of federal and state income taxes, both with and without the donation. To do so, we have created a tax calculator that relies on historical data on the state and federal income tax systems from 1987 to 2012. The calculator, written in Matlab, takes as input the real AGI of a hypothetical taxpayer and the value of the taxpayer's easement donation. It calculates the taxpayer's federal and state tax bills, taking into account the federal deductibility of state taxes and any state tax credit available. Here we provide an overview. In appendix B we give more detail.

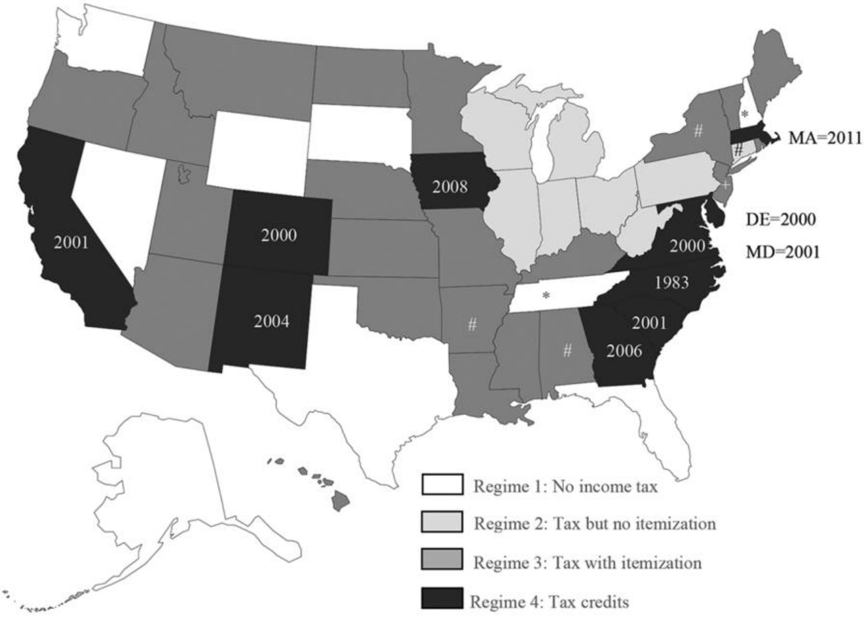

Figure 2. State income tax regimes in 2012. Years indicate when the initial tax-credit legislation was first in force. # indicates that states have conservation easement specific tax incentives, but ones that are relatively weak and not based on income taxes. * indicates the state only taxes dividend and investment income but not wage income. + New Jersey does not in general allow itemized deductions but began to allow itemization of conservation easements in 2000. California's program has operated intermittently since 2001.

For federal taxes, the calculator reads in tax brackets, tax rates, personal exemptions, and standard deductions for 1987–2012 as provided by the Tax Foundation.[12] The calculations assume the taxpayer is married filing jointly, takes a noneasement deduction equal in amount to the standard deduction, and claims two personal exemptions. In the easement donation case, deductions from income are extended beyond the amount of the standard deduction by the appraised value of the easement.

To account for changes in the value of the dollar, the assumed AGI and the value of the donation are adjusted to 2012 constant-dollar terms. Limits on deductions and carryover rules make the tax calculator dynamic and turn the tax benefit calculation into a present value calculation. For example, charitable donation deductions were limited to 30% of AGI in tax years 1987–2005. In those years, if the value of deductions exceeded 30% of AGI, the unused deduction could be carried into the next tax year. The calculator assumes that the taxpayer makes no additional easement donation

12. http:www.taxfoundation.org/publications/show/151.html.

in the following year but does use the carried over deduction to reduce taxable income. This process is followed in subsequent years until either the entire deduction is used or until the time limit on carryover is reached. Tax benefits that accrue in future years are discounted at an annual rate of 5%.

Although the discussion above begins with the federal tax calculation, the calculator begins with the state tax liability, both with and without the assumed donation. The state taxes owed under the two scenarios are then deducted from income taxable at the federal level. Note that this unified treatment deducts the current year's state taxes paid from the current year's federal taxable income, at variance with the fact that when calculating one's federal tax bill for a calendar year, one deducts state taxes withheld in that same year and adds to income refunds rising from over-withholding of state tax in the previous year. This allows us to avoid making assumptions about withholding strategies and prior-year tax status issues.

To characterize state tax systems, we have transformed data on each of the 50 states over 1987–2012 into a schedule of tax brackets and tax rates using the annual *All States Tax Handbook* published in different years by Prentice Hall and by the Research Institute of America. We rely on the same handbooks as a data source for documenting whether or not the state recognized itemized charitable deductions. In those states and years that levied an income tax and allowed deduction of charitable contributions, we assume that the percentage-of-AGI limitations and the carryover limits at the state level were the same as those at the federal level.[13]

Aside from the four categories of states illustrated in figure 2, the tax calculator tracks other, more subtle, differences.[14] For states that distinguish between wages on the one hand, and interest and dividend income on the other, the calculator arbitrarily assumes that all AGI is wage income. Finally, the calculator assumes that easement donors in the four states that allow the sale of tax credits sell their credits for 85 cents on the dollar, a figure consistent with the observed prices of transferable credits.

2.3. Calculator Output

We measure the salient tax incentive to donate by an after-tax price of conservation index, defined in section 1, equation (14), as follows:

13. Some states allow the deduction of federal taxes from state taxable income; however, the tax calculator makes the simplifying assumption that federal taxes are not allowed as deductions from state taxable income.

14. The different tax systems that we account for are (1) states in which income tax is a fixed fraction of a filer's federal tax, (2) states that tax wage and dividend income at different rates, (3) states in which personal exemptions are taken in the form of tax credits, (4) states that have easement tax-credit programs that allow filers to take both the charitable donation and the tax credit, and (5) tax-credit states that allow either a deduction or a credit, but not both (filers are assumed to take the credit). States also switch categories over time—notably those states that institute easement tax-credit programs—and the tax calculator tracks those changes.

$$\tilde{P}_C \equiv \frac{C - \Delta\tilde{T}}{C} = 1 - \frac{\Delta\tilde{T}}{C},$$

where $\Delta\tilde{T}$ = *PV of tax liability without donation – PV of liability with donation*, taking as given the taxpayer's AGI and the easement donation, C. The variable $\tilde{P}_C$ measures the after-tax price per dollar of easement donation. We begin by assuming that none of the donation's value would be subject to capital gains taxation absent the donation.

Figure 3 illustrates the price of conservation under this scenario for the seven states lacking income taxes, for four different taxpayer AGIs: $100,000, $200,000, $350,000, and $1 million. Because the states have no income tax, the tax benefits from an easement donation flow entirely from the federal code.

To focus first on the role of marginal tax rates, we assume the donation value in panel A is only $1,000 so that the taxpayer never runs into the percentage-of-AGI limits. For a small enough donation, the measured price becomes an algebraic transformation of the relevant marginal tax rate: $\tilde{P}_C = (1 - \tilde{\tau})$.[15]

Panel A of figure 3 shows the calculator output. Focusing first on the end of the sample period, the year 2012, we see that price declines with taxpayer AGI. The top line shows the after-tax price per dollar of donation to be $0.75 for the taxpayer with an AGI of $100,000, because her marginal rate was 25%. By contrast, the taxpayer with an AGI of $1 million paid a marginal rate of 35%, so her price in 2012 was $\tilde{P}_C = 1 - 0.35 = 0.65$.[16]

Panels B and C show the calculator output for taxpayers in the same states, but who make larger donations, appraised at $500,000 and $1 million. The prices in these cases illustrate the effects of AGI limitations on deductions and carry-forward limits. Prior to 2006, the price increased with donation size primarily because of the 5-year carry-forward limit. Because of the AGI limits and the carry-forward constraints, the taxpayer with AGI = $100,000 could deduct only 0.30 × $100,000 = $30,000 each year for 6 years, leading to a total deduction of $180,000. Moreover, deductions in later years yield declining financial benefits due to the 5% discount rate. The price falls for the lower income donors in 2006 primarily because the carry-forward period was extended from 5 to 15 years. The AGI limitation was also increased for qualifying farms and forests from 30% to 100%. Hence, a qualifying landowner with AGI = $100,000

15. The price is calculated based on tax rates and rules during the year of the contribution. Taxpayers are assumed to expect current rates and rules to reign in the future. Our empirical analysis in the next sections considers the possibility that taxpayers are able to anticipate future changes in the tax code.

16. The increases in the price across all AGI categories from 2001–3 are due to tax rate cuts during the George W. Bush administration. The sharp rise and then decline in the price at the higher AGIs during 1987–93 reflect changes in tax rates and brackets initiated by tax legislation passed in 1986, 1990, and 1993.

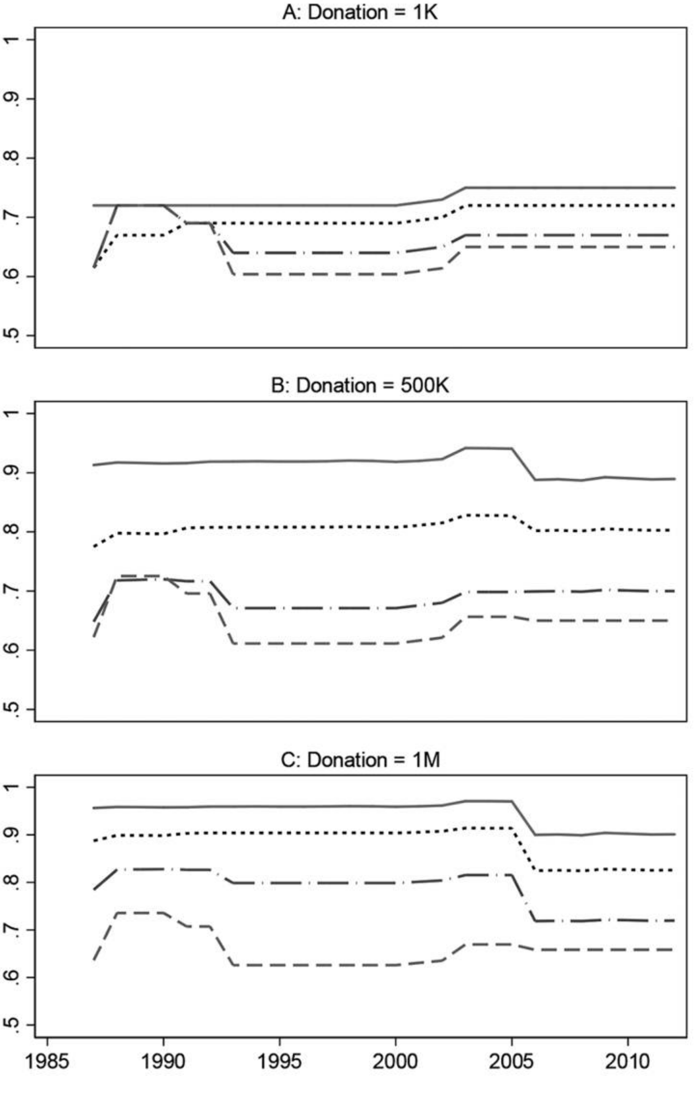

Figure 3. Donation price due to federal conservation policy incentive. The legend is as follows. AGI $100,000 is the solid line. AGI $200,000 is the dotted line. AGI $350,000 is the long dash-dotted line. AGI $1,000,000 is the dashed line. We assume the AGI $100,000 and AGI $200,000 donors are qualified farmers and the higher AGI donors are not. All scenarios assume that none of the donation's value would otherwise be subjected to capital gains taxation.

would fully exploit the $500,000 donation in 5 years, which lowers the price of conservation from 0.94 to 0.89.[17]

Appendix C includes graphs of the price in each of the 50 states, and figure 4 summarizes the output by comparing the mean price across states with the four tax regimes. We focus on a landowner with an AGI of $100,000 and assume he owns a qualifying farm or forest. As above, we continue to assume that none of the easement's donated value would otherwise be subject to capital gains taxation. The donation size varies as before, from $1,000 to $500,000 to $1 million.

There are two take-away points from figure 4. First, the price falls as we move from regime 1 (no state income tax) and regime 2 (no deduction allowed), to regime 3 (deduction allowed but no credit), to regime 4 (tax-credit states).[18] Second, most of the time series variation is driven by changes in the federal code and by the introduction of credits in some states. For the tax-credit states, the mean price begins to fall in 2000 and there is a gradual decline through 2012, mostly due to additional states adding tax credits over time. The mean price does not monotonically fall within tax-credit states because some credit programs fluctuated in generosity over time.

2.4. Taxation on Capital Gains

The prices described heretofore are calculated assuming the farmer would have no exposure to taxation on capital gains if he did not donate an easement. This is true if the value of development rights has not appreciated beyond basis, which is unlikely, or if the farmer can avoid taxation on capital gains when the land is transferred as discussed above.

We approximate the additional incentive to donate for a farmer who would otherwise be exposed to capital gains taxation (see fig. 5). First, we calculate the price as above. Second, we assume that a certain amount of the donation—λg from the theory—would be exposed to long-term capital gains absent the donation. (In the output generated for figs. 3 and 4, the assumed proportion is zero.) Third, we employ NBER's TaxSim (http://users.nber.org/~taxsim/taxsim9/) and input the scenario. Fourth, we extract the combined federal-state marginal rates on capital gains and multiply the rates by the proportion of the donation that would have otherwise been subject to capital gains taxation. Fifth, we subtract this effective marginal rate—which is a proxy for $\bar{\tau}\lambda g/C$ in the theory—from the calculator's price estimate.

17. The landowner benefits from the carry-forward extension but can be harmed by the requirement that he must donate the full $100,000 each year. He could be better off if he was allowed to spread the $500,000 donation over more years, allowing him to eliminate his tax liability for a longer time span. We thank Guido van der Hoeven for helpful discussions on this point.

18. The price is slightly lower in the regime 1 states because, in these states, the donation does not reduce the amount of state income taxes the donor would have otherwise been able to deduct against her federal tax burden.

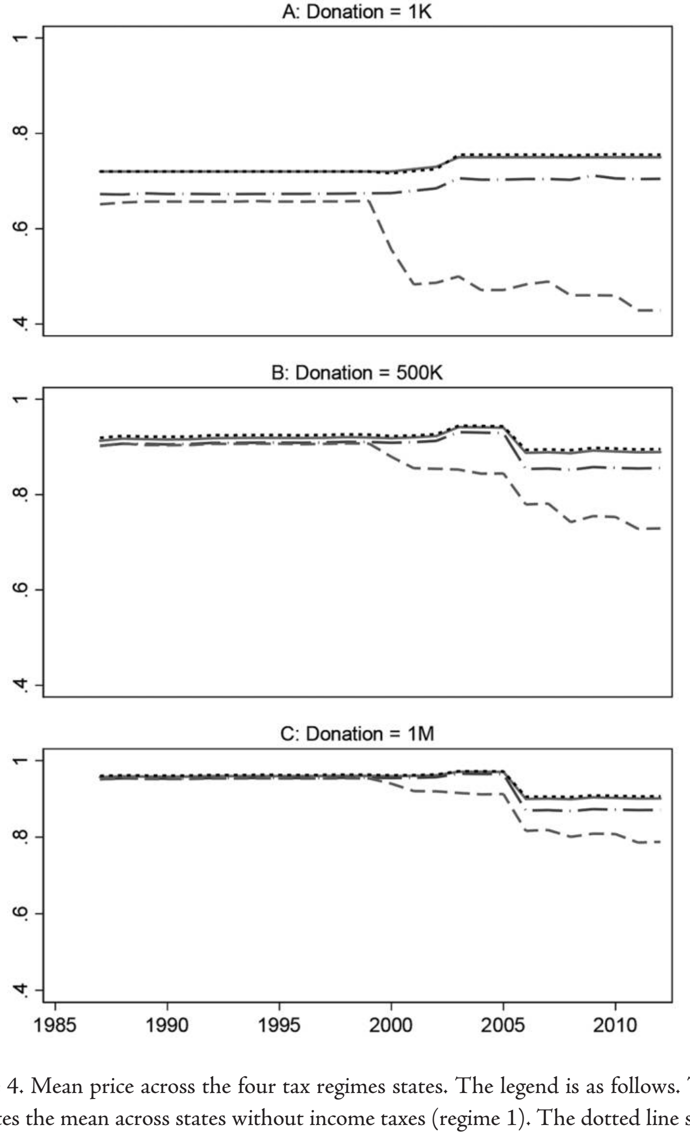

Figure 4. Mean price across the four tax regimes states. The legend is as follows. The solid line denotes the mean across states without income taxes (regime 1). The dotted line shows the means across states that have income taxes but do not allow itemized charitable deductions (regime 2). The dash-dotted line shows the means across states that have income taxes and allow itemized deductions (regime 3). The dashed line shows the means across states that introduced easement-specific tax credits (regime 4). All scenarios assume that the donor is a qualified farmer and that none of the donation's value would otherwise be subjected to capital gains taxation. The assumed AGI is $100,000 in each scenario.

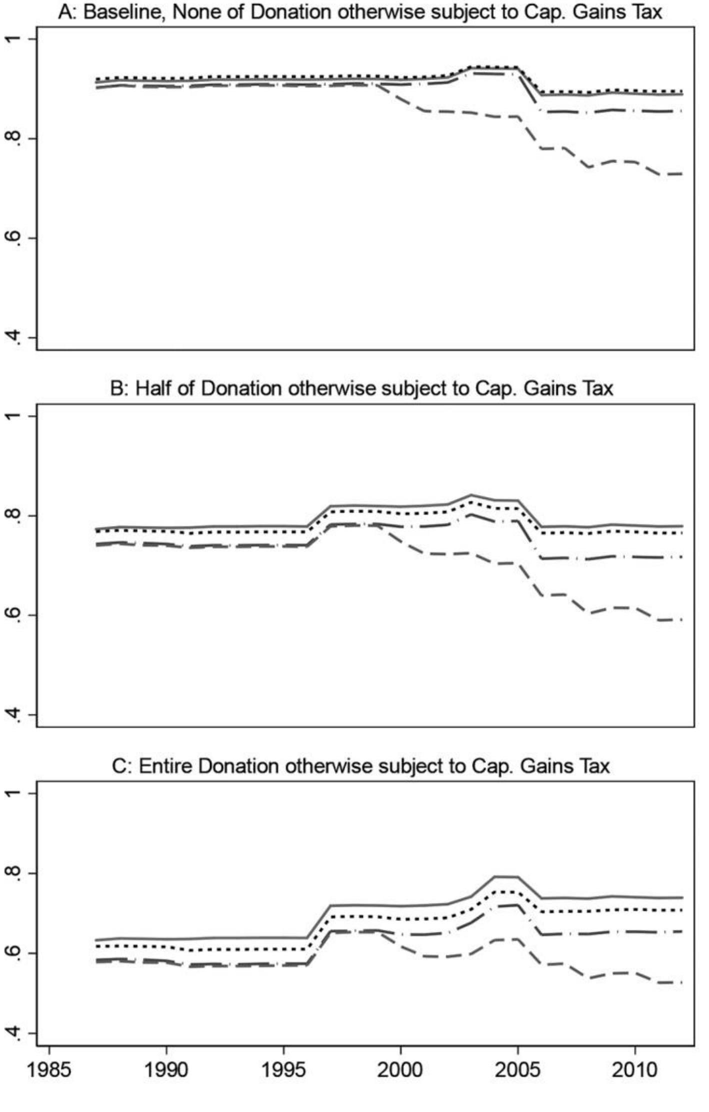

Figure 5. Effect of adding capital gains exposure. The lines have the same interpretations as figure 4. All scenarios assume that the donor is a qualified farmer, that AGI is $100,000, and that the donation value is $500,000.

Figure 5 shows price indices that incorporate capital gains. The scenario is AGI $100,000 with a donation of $500,000. Panel B assumes that half of the donation—$250,000—would otherwise be subjected to taxation on (long-term) capital gains, and panel C assumes that all $500,000 would otherwise be taxed. The resulting donation price is lower when compared to the baseline case of no exposure. Some other time-series patterns are evident, especially in the full exposure scenario, which shows sharp price changes emanating from decreases in the federal tax rate on capital gains: from 28% to 20% in 1996–97, and from 20% to 15% in 2003–4. Across all panels, the largest systematic variation in price stems from income tax credits.

3. DATA ON CONSERVATION EASEMENT HOLDINGS

We have created state-level panel data sets indicating the number and acres of easement acquisitions by land trusts over 1987–2012. The acreage measure is arguably more useful than a dollars-donated measure because acres more closely approximate the open space output of land trusts. Hence, our analysis differs from other studies of the response of charitable giving to tax policy in that we more directly measure the relationship between tax policy and public good provision.[19]

The ideal annual state-level panel data set for our purposes would span all land trust holdings of conservation easements and would indicate which parcels were donated and which were purchased. We do not have this ideal data set. We have, however, constructed two annual state-level panels that come close to the ideal in different respects. Table 2 summarizes the strengths and weaknesses of each data set.

The first—the TNC data set— is national in coverage and includes all easement acquisitions made by the Nature Conservancy (TNC). TNC is the country's largest trust, holding approximately 23% of land trust conservation easements in 2010. TNC provided us with data on their holdings of easements and owned land at the county level, on an annual basis, from 1987 to 2012. In addition to being national in coverage, the strength of the TNC data set is that it indicates which easement parcels were donated and which were purchased. The weakness is that it represents the actions of one land trust rather than all land trusts.

The second data set—the NCED data—is from the National Conservation Easement Database.[20] The strength of the NCED data set is that it includes information

19. One advantage of our approach is that acres held is a more verifiable result of tax policy, when compared to dollars donated (Fack and Landais 2016). The ability to study the dollar value of easement donations is limited by the lack of detailed panel data such as we have assembled on acres. We do think that working with what IRS administrative dollar-value data are available, such as those referenced by Looney (2017), would be a fruitful avenue for future research.

20. According to the NCED website, it is "the first national database of conservation easement information, compiling records from land trusts and public agencies throughout the United States. . . . This effort helps agencies, land trusts, and other organizations plan more strategically, identify opportunities for collaboration, advance public accountability, and raise the profile of what's happening on the ground in the name of conservation." See http://conservationeasement.us/about.

Table 2. Characteristics of Land Trust Data Sets

Data Set	Includes State and Local Land Trusts?	Annual Panel?	National Coverage of Easements?	Indicates Donations vs. Purchases?
TNC	No	Yes	Yes	Yes
NCED	Yes	Yes	Yes, with gaps	No
LTA	Yes	No (periodic)	Yes	Partially

Note. The NCED (National Conservation Easement Database) data are available at http://conservationeasement.us/about. The Nature Conservancy (TNC) and Land Trust Alliance (LTA) data were provided to us by database managers of those organizations.

on the location of easements held by most land trusts, and the year of acquisition, across the entire country.

There are two weaknesses of the NCED data set. First, although we know that the vast majority of easements in the NCED data set were donated to land trusts, the data set does not indicate which easements were acquired through purchase. This limitation is worth keeping in mind when interpreting the estimated effects of tax policy on easement flows from the NCED data. The estimated effects likely understate the effect of tax policies on donation flows because some of the easements were purchased by trusts.

The second weakness is that the NCED data coverage of easements is incomplete. Some land trusts have not yet sent spatial GIS files to the NCED and not all of the data sent to the NCED have been mapped.[21] In a robustness check, we show that our estimates are similar when we weight the regression results by the proportional completeness of easement coverage for each state, which we estimate to range from a low of 1% to a high of over 95% in several states based on comparisons of NCED easement acreage in 2010 with acreage reported in the Land Trust Alliance census of all land trusts that year.[22]

A third data set—the LTA data set—is one that we do not employ in the panel regressions but do use in our assessment of the precision and quality of land trust con-

21. According to the NCED website, easements that are known are yet not in NCED because (1) they have not been digitized, (2) they were withheld from NCED, or (3) the NCED team is still working with the easement holders to collect the information.

22. The variation in estimated completeness, at the state level, is not correlated with our state-level variables of interest. In 2010, the correlation between completeness of NCED coverage and our price of conservation is only 0.05, based on the AGI and value of donation assumptions we use in the calculation of the price, described below. The correlation between the NCED coverage and the stock of easements held by land trusts in 2010, according to the Land Trust Alliance census during that year, is only −0.004. These low correlations assuage concerns that our estimates based on the NCED data are biased by incomplete coverage.

servation. The Land Trust Alliance (LTA) is a trade organization for land trusts, with over 1,500 members. On an irregular basis, LTA surveys its members about their easement holdings and conservation practices. The weakness of this data set is that we cannot construct an annual panel from it.

Table 3 shows summary statistics for the panel data sets and highlights two statistical issues that we confront in the empirical analysis. First, there are several state-year combinations for which the outcome variables are zero in the TNC and NCED data sets. Second, there are large outliers in acres acquired—for example, the 610,814 acre maximum in the NCED data sets reflects an enormous forestry easement acquisition in Maine in 2001. The 244,753 acre maximum in the TNC data set reflects a large ranchland easement acquisition by the TNC, in New Mexico during 2004 (see Parker and Thurman 2011).

4. EMPIRICAL ANALYSIS OF TAX INCENTIVES

Before estimating panel regressions, we provide graphical evidence to motivate the potential importance of state variation in the tax code in explaining private conservation.

4.1. Graphical Evidence

Figure 6 compares the annual flow of easement acquisitions in the TNC and NCED data sets across tax-credit and non-tax-credit states. Panels A and B compare mean counts and panels C and D compare mean acreage. To normalize for differences in the land area of states, we have divided acreage flows by the number of privately owned

Table 3. Summary Statistics of State Panel of Land Trust Acquisitions

	The Nature Conservancy (TNC)			National Conservation Easement Data (NCED)
	All (1)	Purchased (2)	Donated (3)	All (4)
Easements count:				
Mean	1.60	.454	1.15	12.36
Min	0 [635]	0 [972]	0 [754]	0 [403]
Max	31	14	31	255
Easements acres:				
Mean	2,439	783.5	1,655	4,953
Min	0	0	0	0
Max	244,753	149,993	244,753	610,814

Note. The summary statistics are for a state-level panel spanning 1987 through 2012 (N = 1,300, t = 26, i = 50). The number in brackets indicates the number of observations for which the value is zero. Column 3 combines All Gift and Partial Gift categories from TNC. The TNC data were sent to us by the database manager. The NCED data were downloaded from http://conservationeasement.us/ (updated in July 2015). NCED data do not indicate if an easement was donated or purchased.

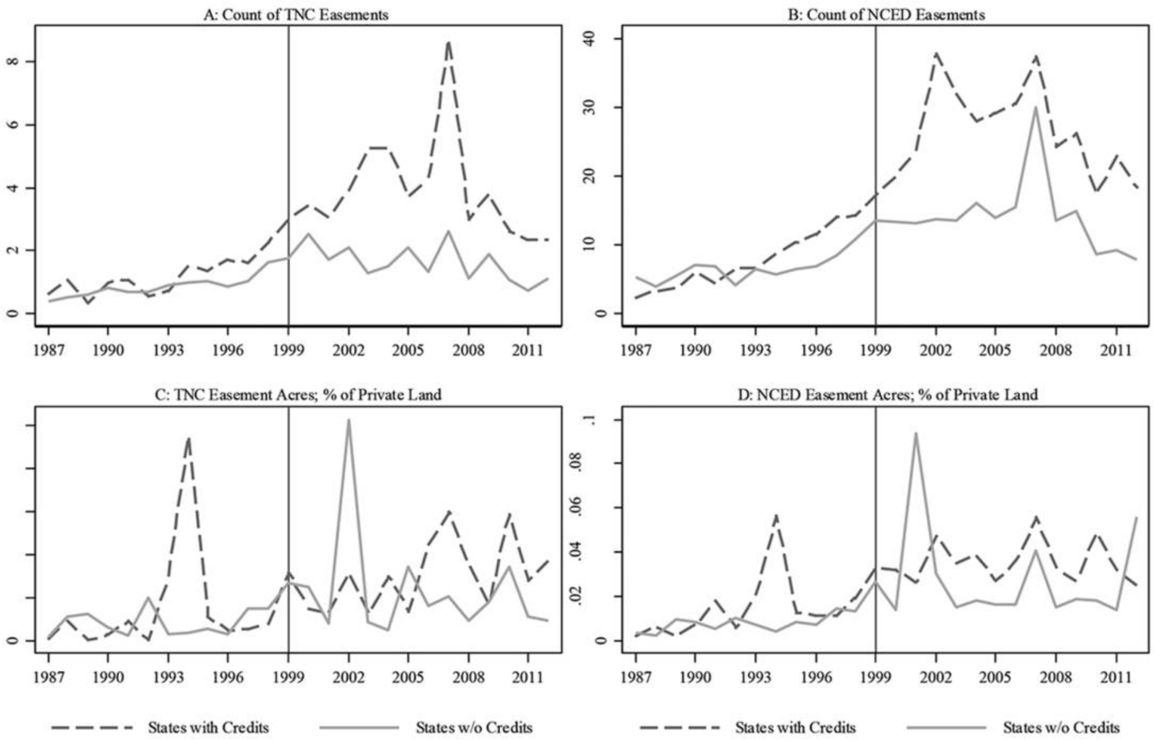

Figure 6. Mean annual flow of easements in states with and without tax credits. The vertical line signifies 1999, which is the final year before the states began introducing new tax-credit programs (with the exception of North Carolina).

acres.[23] The vertical line is at 1999, the year before states (other than North Carolina) began introducing new programs.

Panels A and B provide visual evidence that the introduction of tax credits triggered an increase in the count of easements acquired by land trusts. Prior to 1999, trajectories in easement donations were similar across the two categories of states. Beginning in 2000, the flow of easements expanded in the tax-credit states and the gap in means between the two types of states widened.

The relative pre-tax-credit and post-tax-credit trends are less clear in panels C and D, which show acreage flows. The spike in 1994 is due to a large ranchland easement transaction in New Mexico, a tax-credit state that launched its program in 2004. The spike in 2001 and 2002 is due, in part, to a large forestry easement in Maine, which does not have a tax-credit program. If one ignores these two prominent spikes, then panels C and D show that the mean acreage was trending similarly across the two types of states until around 2000, after which there was relative growth in acreage in the states with tax credits.

All panels in figure 6 show a prominent spike in easement acquisitions in 2007, in both tax-credit and non-tax-credit states. We note that 2007 is the first full year in which taxpayers could take advantage of the 2006 extension of the carry-forward period from 5 to 15 years.

Figure 6 suggests two other possible dynamic responses to changes in the price of conservation. First, in some panels there appears to be a decline in easements in the year prior to a decrease in the price. This suggests that donors may have temporarily withheld their donations in anticipation of forthcoming benefits. Panel A and especially panel B also suggest that the flow of easement acquisitions may have responded to short-run changes in the price—rather than long-run decreases in the level—given the expanding and then shrinking gap between the flow of easements in tax-credit and non-tax-credit states during 2000–2012. We explore these dynamic issues in the regression analysis.

4.2. Econometric Model

Our basic strategy is to estimate an equation of the form

$$\begin{aligned} Ihs(easements)_{it} = {} & \alpha_i + \phi_t + \omega_i t + \beta_1 \Delta \ln P_{i,t+1} \\ & + \beta_2 \ln P_{it} + \beta_3 \Delta \ln P_{it} + X_{it}\eta + \epsilon_{it}\,. \end{aligned} \tag{15}$$

23. The "private acres" denominator is the sum of acreage held by the federal government plus state-owned parks and recreation land. We treat the denominator as time invariant and use the stock of government landholdings in 2000 for the calculations.

Subscripts i and t refer to state and year, *Ihs* refers to the inverse hyperbolic sine transformation.[24] Variable P is the "price of conservation" index.

We allow each state to have its own time-invariant intercept (α_i) to control for geographic, topographical, cultural, and institutional differences across states. We also allow for time shocks that might affect rates of easement donations across all states (ϕ_t). Such factors include changes in the federal estate tax code, national recessions, and informational shocks about the ecological value of land conservation. In our preferred specifications, we also include state-specific linear time trends ($\omega_i t$).

We employ the price index generated from a donation of $500,000 from the owner of a qualifying farm or forest with an AGI of $100,000 (all in 2012 dollars). The index assumes the donor would be exposed to a tax on long-term capital gains of $250,000 if he did not make the easement donation (see fig. 5, panel B). We choose the AGI and donation amount combination because it induces the best econometric fit among the combinations displayed in figure 3, based on comparisons of adjusted R-squared from estimates of (15). The assumed donation of $500,000 is close to the mean of actual easement donations during 2003–12, which was $475,416.[25] The AGI value of $100,000 may seem low, but IRS summary data show that 81% of all US farm returns were from filers with AGI less than $100,000 and 94% were from filers with AGI less than $200,000.[26] IRS data also indicate that 63% of easement donations came from taxpayers with AGI of less than $200,000 in 2012. The 50% capital-gains exposure scenario follows previous literature, and it closely matches the percentage of farmland sales proceeds represented by capital gains.[27]

The coefficient of key interest is β_2. It measures the persistent response in the flow of easement donations to a persistent change in the price of conservation. We expect

---

24. Except for values very close to zero, the inverse hyperbolic sine is approximately equal to $\log(2y)$ so it can be interpreted in the same way as a standard logarithmic dependent variable. The inverse hyperbolic sine provides the benefit of being defined at zero, allowing us to retain the information contained in the $y = 0$ observations (Burbidge et al. 1988; MacKinnon and Magee 1990).

25. See www.irs.gov/uac/SOI-Tax-Stats-Special-Studies-on-Individual-Tax-Return-Data#noncash.

26. These data are from 2007, available at www.irs.gov/pub/irs-soi/11inbystatesprbul.pdf, reported in table 1.

27. See www.irs.gov/uac/soi-tax-stats-sales-of-capital-assets-reported-on-individual-tax-returns. Those data show that 44.2% of the sales price of farmland was long-term capital gains over 2007–12. A 50% gains-to-value ratio is also assumed (or estimated) in other studies of tax incentives and charitable giving, such as Feldstein (1975), Randolph (1995), and Barrett et al. (1997). More in-depth analysis by Bakija and Heim (2011) estimates the ratio to be 0.59 for noncash assets in general and multiplies that ratio by a discount factor of 0.7 to account for delays in the timing of asset sales in a nondonation scenario.

$\beta_2 < 0$. Because the price of conservation is logged, and the dependent variables are transformed by the inverse hyperbolic sine function, β_2 is a long-run "price" elasticity.

The other coefficients represent dynamic responses in a parsimonious way. Following Bakija and Heim (2011), we control for the possibility that donors respond to expected changes in the price in the year preceding the change. Hence, β_1 measures the anticipatory response of easement donations to a future change in the price. We expect $\beta_1 > 0$ if donors can anticipate future changes and withhold donations when the donation price is expected to decrease in the next period. The coefficient β_3 measures any additional first-period response to a change in the price beyond the long-run effect. If potential donors think a favorable change in the tax code may be temporary, or if land trusts aggressively recruit donations in the immediate aftermath, then we should observe $\beta_3 < 0$.

The variables in $\boldsymbol{X}$ include state-year level controls for a land price index, population, farm income, forest income, total per capita income, and government acquisitions of easements through purchasing programs. Appendix D provides summary statistics, definitions, and data sources.

4.3. Results

Table 4 shows the first set of regression estimates. The dependent variable is the count of easement acquisitions. Columns 1–6 employ TNC data and columns 7 and 8 employ NCED data. All estimates include the covariates, and columns 4–6 and 8 add state-specific linear trends. Including trends improves the goodness of fit of all regression models. These are our preferred estimates. The standard errors in all estimates are clustered at the state level to control for possible serial correlation in errors within states. We omit the tax bubble years of 1987–91 because the estimates during those years are much more sensitive to the choice of donation and AGI combinations. Hence, our estimates focus on the 1992–2012 panel of 21 years.[28]

We begin by interpreting the $\hat{\beta}_2$ coefficients, the long-run response of easement flows to a change in the price. Starting with column 5, which is our favored estimate using the TNC data, there is a persistent negative relationship between the price and the flow of all easements, donated and purchased. The estimate is a statistically precise and economically large elasticity of −1.89. For comparison, the dependent variable in column 6 is the count of easements purchased by TNC. The estimate in this column

28. While the goodness of fit is best for the AGI = \$100,000, donation = \$500,000 scenario for 1992–2012, the fit is better for a higher income scenario during the bubble tax years of 1987–91. This may be because conservation easement donations were relatively more concentrated among higher income donors in the early years of land trusts, compared to today. Rather than using different AGI scenarios for different years, we employ a simpler procedure and hold constant the AGI and donation size scenario over time.

Table 4. Fixed Effects Estimates of the Number of Easement Acquisitions

	TNC All (1)	TNC Donated (2)	TNC Purchased (3)	TNC All (4)	TNC Donated (5)	TNC Purchased (6)	NCED All (7)	**NCED All (8)**
Anticipatory effect (β_1)	–.075	–.313	.734**	–.735	–1.001	.921*	.670	**.232**
	(.617)	(.567)	(.359)	(.525)	(.631)	(.510)	(1.177)	**(.556)**
Short-run effect ($\beta_2 + \beta_3$)	–2.210***	–2.545***	.646*	–2.926***	–3.267***	.879	–3.841***	**–4.520*****
	(.701)	(.657)	(.377)	(.566)	(.789)	(.612)	(.663)	**(.729)**
Long-run effect (β_2)	–1.685**	–1.775**	–.798	–1.613***	–1.899**	.226	–.507	**–2.347*****
	(.755)	(.728)	(.568)	(.597)	(.911)	(.442)	(.609)	**(.823)**
Controls:								
Land price index	–.046**	–.056***	.011	–.029	–.040	.017	–.097***	**–.011**
LN forest income	.389**	.327*	.100	.269	.091	.165	–.332	**.054**
LN farm income	–.077	–.035	–.113	–.137	–.338	.285	.667	**.633****
LN per capita income	.658	.820	–.415	1.116	1.343	–.302	–1.214	**1.167**
LN population	.164	.428	.018	2.009	2.129	–.165	–.592	**–1.816**
Govt. easement acres	–.006	–.008	–.001	–.003	–.011	.008	.021	**.007**
State fixed effects	x	x	x	x	x	x	x	**x**
Year fixed effects	x	x	x	x	x	x	x	**x**
State-specific trends				x	x	x		**x**
Adjusted R^2 (within)	.145	.138	.066	.222	.202	.158	.346	**.529**
N	1,000	1,000	1,000	1,000	1,000	1,000	1,000	**1,000**

Note. The standard errors presented in parentheses are clustered at the state level. The observations are state-year combinations from 1992 through 2012. The dependent variable is the count of easements acquired, transformed by the inverse hyberbolic sine function. Column 8 appears in bold font to signify that it is our preferred specification.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

serves as a placebo test. We do not expect purchases to be directly influenced by the tax price if in fact the price is causally related to easement flows rather than nontax influences that also drive easement donations to land trusts. The placebo regression in column 6 shows that $\hat{\beta}_2$ is effectively zero. This null finding raises confidence that the columns 4–5 coefficients are not simply driven by unobserved, demand-side drivers of easement acquisitions.

The long-run elasticity estimates are larger in our favored estimate of the NCED data, which is given in column 8 as −2.35. This is our favored estimate in the table because it employs data from all land trusts and because it includes state-specific time trends. Comparing the NCED $\hat{\beta}_2$ estimates against those of TNC, the long-run response of easement counts to tax policy is greater for the smaller, local land trusts that comprise the NCED data set. This finding suggests that the smaller trusts are more dependent on donations, which is consistent with the observation that TNC has a large budget for purchases whereas many smaller trusts do not.

Turning to the dynamic effects of tax policy, consider the estimates of $\hat{\beta}_1$ and $\hat{\beta}_2 + \hat{\beta}_3$. There is no evidence of a significant anticipatory effect as $\hat{\beta}_1$ is imprecisely estimated and not distinguishable from zero in all of the columns including donations. There is, however, evidence of a stronger response to the price of conservation in the first period following a tax code change. In all of the columns including donations the short-run response of $\hat{\beta}_2 + \hat{\beta}_3$ exceeds the long-run response indicating that the flow of donated easements surged in the first year of a tax price decline. This surge may indicate that landowners consider tax benefits to be temporary and therefore move quickly to exploit them. The positive estimate of $\hat{\beta}_2 + \hat{\beta}_3$ in column 3 is interesting. It implies that TNC purchased fewer easements in the first year of a decline in the tax price of easements. This result suggests that a new tax credit, or a lower tax rate, may crowd out easement purchases, at least temporarily.

Table 5 shows regression estimates of easement acres, rather than counts. The specifications are identical to those in table 4 and the price of conservation coefficients are again elasticities. In general, the patterns in table 5 mimic those in table 4 but there is a key difference. The long-run elasticities of $\hat{\beta}_2$ for donated easement acres tend to be much larger than those for donated counts, but the acreage elasticities are also less precisely estimated.

We turn first to the TNC coefficients in table 5, focusing on column 5. The $\hat{\beta}_2$ coefficient is negative and economically large but imprecisely estimated, with a *t*-statistic of 1.04. The sum of $\hat{\beta}_2$ and $\hat{\beta}_3$ is significant, however. Taken together, these results mean that a decrease in the tax price induces a surge in acreage donated to TNC in the first year following the tax change. In the longer run, however, the lower tax price does not continue to influence the flow of acreage donated to TNC. How does this result reconcile with the statistically significant column 5 estimate of $\hat{\beta}_2 = -1.89$ in table 4? One possibility is that prospective TNC donors of large easements are more immediately responsive to changes in tax prices than are prospective TNC

Table 5. Fixed Effects Estimates of the Acreage of Easement Acquisitions

	TNC All (1)	TNC Donated (2)	TNC Purchased (3)	TNC All (4)	TNC Donated (5)	TNC Purchased (6)	NCED All (7)	**NCED All (8)**
Anticipatory effect (β_1)	2.768	1.542	4.447**	2.024	.617	6.054*	4.311*	**2.390****
	(1.820)	(1.965)	(2.093)	(2.651)	(2.453)	(3.102)	(2.334)	**(1.094)**
Short-run effect ($\beta_2 + \beta_3$)	−8.219***	−8.947***	3.352	−8.857*	−9.651*	5.471*	−4.094**	**−7.043****
	(2.725)	(2.864)	(2.103)	(4.990)	(4.832)	(2.933)	(1.818)	**(3.089)**
Long-run effect (β_2)	−2.848	−3.433	−4.474	−.817	−2.046	2.201	.210	**−6.075****
	(2.656)	(2.446)	(3.651)	(1.603)	(1.970)	(1.895)	(1.218)	**(2.899)**
Controls:								
Land price index	−.070	−.102	.049	−.078	−.063	−.030	−.125*	**.089**
LN forest income	1.345*	1.155	.583	.913	−.396	1.052	−.899	**.684**
LN farm income	.184	.343	−.635	−.910	−.991	.357	2.373**	**1.684***
LN per capita income	2.076	1.990	−2.703	4.516	3.494	−.115	−1.828	**−.650**
LN population	−2.803	.824	−.885	8.179	12.609	−2.450	−2.532	**1.971**
Govt. easement acres	−.018	−.028	−.008	.004	−.038	.053	.005	**−.018**
State fixed effects	x	x	x	x	x	x	x	**x**
Year fixed effects	x	x	x	x	x	x	x	**x**
State-specific trends				x	x	x		**x**
Adjusted R^2 (within)	.089	.078	.069	.134	.120	.140	.222	**.348**
N	1,000	1,000	1,000	1,000	1,000	1,000	1,000	**1,000**

Note. The standard errors presented in parentheses are clustered at the state level. The observations are state-year combinations from 1992 through 2012. The dependent variable is the acreage of easements acquired, transformed by the inverse hyberbolic sine function. Column 8 appears in bold font to signify that it is our preferred specification.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

donors of small easements, perhaps because large easement donors have more to lose if they do not act quickly to exploit tax benefits that could be temporary.[29]

Turning to the NCED tax price estimates in column 8, the long-run $\hat{\beta}_2$ elasticity is large, at –6.07 compared to a statistically insignificant elasticity of –2.05 for TNC acres in column 5. This means that the long-run flow of easement acreage to small, local land trusts is more sensitive to tax prices when compared to the long-run flow to TNC. The first-period response ($\hat{\beta}_2 + \hat{\beta}_3$) is larger for TNC: at –9.65 versus –7.04. The fact that TNC easements tend to be larger than NCED easements may help explain this difference, assuming that large landowners are more anxious to quickly exploit decreases in easement donation prices.

To summarize tables 4 and 5, we find large, negative elasticities with respect to persistent changes in the tax price of conservation. For the NCED data, which include a comprehensive set of land trusts, our favored estimates are –2.35 for easement counts and –6.07 for easement acreage. These estimates quantify how the long-run flow of easements responds to a change in the tax price of donations. Because easements are perpetual, the long-run stock is also important. For the NCED data, our favored estimate indicates that the long-run stock of acres would increase in addition to the flow response, by 7.04 times the percentage change in price.

The elasticity estimates summarized above are conditional on covariates and state-specific time trends and are robust to placebo tests of easement purchases by TNC. Although the placebo and time trends results help to justify a causal interpretation of tables 4 and 5, we perform a series of robustness checks in appendix E. That appendix describes various threats to identification, and it provides tests to account for those threats. The appendix also presents estimates using scenarios other than AGI = \$100,000, donation = \$500,000. We conclude that the main elasticity estimates, –2.4 for easement donation counts and –6.1 for easement acres, provide a meaningful and robust characterization of easement responses to tax incentives.

5. IMPLICATIONS: AGGREGATE ACREAGE OUTCOMES AND THE QUALITY OF EASEMENT DONATIONS

To assess the quantitative importance of tax code changes whose stated purpose was to increase easement donations, we simulate the effects of adopted tax credits based on our baseline short- and long-run elasticity estimates of –7.0 and –6.1. Table 6 shows the simulated changes due to the introduction of state tax-credit programs actually instituted.

In Colorado, for example, the new program lowered the price for our representative landowner (AGI = \$100,000, donation = \$500,000) by 25% relative to the price in

29. The incentive to act quickly could be especially strong for large donors because many of the tax-credit programs cap the aggregate value of claimed credits at the state-year level, perhaps inducing a race among large donors to become eligible before the cap is exceeded.

Table 6. Simulated Changes in Donated Acre Flows due to Introduction of Credit Programs

						Simulated Percent Changes		
State	Year of Tax Credit	Credit Percentage	Dollar Limit	Transferable	Years to Carry Over	Price of Conservation	Short-Run Acres	Long-Run Acres
NC[a]	1989	25%	25K	No	5	−4.3	30.6	26.4
CO	2000	100%	100K	Yes	20	−24.7	197.1	164.8
DE	2000	40%	50K	No	5	−3.6	25.1	21.6
VA	2000	50%	50K	Yes	5	−13.2	96.4	82.4
MD	2001	100%	80K	No	15	−8.7	62.3	53.5
SC	2001	25%	1,000K	Yes	50	−25.0	199.8	167.0
NM	2004	50%	100K	No	5	−12.3	89.5	76.6
GA	2006	25%	250K	Yes	5	−4.0	28.4	24.5
IA	2008	50%	100K	No	20	−14.0	102.3	87.4
MA[b]	2011	50%	50K	No	0	−13.5	99.0	84.6
USA[c]	2006	Changes in deductibility rules[c]				−6.6	46.6	40.1

[a] North Carolina's tax-credit program began in 1983, before our sample period. The table reports a change in 1989 from a $5K limit to a $25K limit.

[b] Massachusetts's tax credits are nontransferrable. They are, however, refundable, which in the calculator makes them effectively transferable.

[c] In 2006, the federal code changed, increasing the percentage-of-AGI limit from 50% to 100% and the carryover limit from 5 to 15 years for qualified farmers and ranchers. All calculations assume a qualified farmer with $100K AGI, and easement donation of $500K, and capital gains tax exposure of $250K absent the donation.

the year preceding the program. Our estimates imply a short-run acreage increase of 197% and a long-run increase of 165%. Calculations for other states follow the same procedure. All calculations are based on the change in price induced by the initial tax-credit program; most programs were modified subsequently in ways that significantly changed the price of conservation (see apps. B, C).

Table 6 also simulates the changes induced by the federal tax code changes in 2006, which made more generous the deduction carryover rules for farmers. For our representative landowner, assumed to be a qualifying farmer, the changes lowered the price by 6.6% and stimulated a long-run acreage increase of 40.1%. This simulation illustrates how a modest change in the tax code can stimulate a large increase in annual acreage flows and an even larger eventual increase in the stock of permanently restricted land.

We also ask whether the quality of land preserved—as defined by individual land trusts—is influenced by tax incentives. With respect to quality, it is important to recognize that the tax incentive to donate easements is just that—an incentive to donate easements—and not necessarily to donate ecologically or aesthetically valuable open-space amenities. Just as in the incentive contracting literature (e.g., Baker 2002), the agent (a landowner in our case) is paid to contribute toward an output that can be measured (the acreage of easements), which is not exactly what the principal (the public) is seeking. It is, perhaps, "the folly of rewarding for A while hoping for B."

This implies that land trusts, which intermediate between landowners and consumers of land-based amenities, determine the effect of tax policy on conservation quality. If land trusts accept all easement offerings, regardless of quality, and stronger tax incentives induce donation offerings of marginal quality, then increased tax incentives will disproportionately increase the flow of low-quality easements. If land trusts are selective and focus their limited resources on high-quality easements, however, then increased tax incentives could disproportionately decrease the flow of low-quality easements, by allowing trusts to choose quality offerings from a larger set of prospective donors.

A detailed analysis of the impact of tax incentives on acquisition quality is beyond the scope of our study, but we shed some empirical light. To do so, we exploit data from Land Trust Alliance (LTA) survey questions about conservation outcomes in their 2005 "census of land trusts." Among the questions, trusts were asked to categorize the source of their holdings as purchased, donated, or bargain sale (a mix of the other two). Of the subset of trusts that answered the question, the mean percentage of easements acquired by donation was 79.5%; 13.6% on average were purchased; and 6.9% were acquired through bargain sales (see table 7).

Table 7 also reports a measure of trust-identified conservation quality. Trusts were asked to report the percentage of their easement acreage in areas identified by the trust

Table 7. Descriptive Statistics of Strategic Conservation

	Number of Easements		Percent of a Trust's Easements		
	Mean	SD	Mean	SD	Number of Trusts
Acquisition method:					
All	29.76	97.76			631
Donated	23.88	86.46	79.47	32.30	631
Purchased	2.946	11.64	13.64	27.81	631
Bargain sale	2.934	14.71	6.883	18.45	631
Conservation quality:					
Easements in priority area	23.79	96.64	75.25	30.60	548

Note. Data come from the 2005 Land Trust Alliance survey of trusts. Observations included are those inferred to have responded to the relevant question. The stock of all easements was reported by survey participants. The stock of donated, bargain sales, and purchased easements is estimated by multiplying the reported estimated percentage of easements acquired through each method by the reported stock of all easements.

as conservation priority areas. A 75.3% share of trust-held easements, on average, was located in such areas.

Table 8 uses cross-section regressions at the trust level to connect the measure of quality to the method by which easements are acquired and to link this to the after-tax price of conservation. The first column of table 8 regresses the percentage of a trust's holdings in priority areas on the percentage of easements donated, and on the percent-

Table 8. Trust-Level OLS Regressions of Strategic Conservation

	Y = Percent of Easements in Priority Area			
	(1)	(2)	(3)	(4)
Percent donated	−.172**	−.169*		
	(.041)	(.078)		
Percent bargain sales	−.086	−.053	−.085	−.065
	(.067)	(.097)	(.068)	(.100)
Number of all easements	.011*	.011*	.011*	.011***
	(.006)	(.002)	(.006)	(.003)
Interactions with price of conservation:				
% donated × indicator for first PCon quartile (lowest price of conservation)			−.172***	−.181*
			(.057)	(.100)
% donated × indicator for second PCon quartile			−.131**	−.069
			(.052)	(.084)
% donated × indicator for third PCon quartile			−.161***	−.135
			(.058)	(.085)
% donated × indicator for fourth PCon quartile (highest price of conservation)			−.204***	−.306***
			(.046)	(.083)
Constant	88.283**	87.734**	88.292***	89.414***
	(3.315)	(6.561)	(3.320)	(6.677)
Weighted by number of easements	No	Yes	No	Yes
Observations	432	432	432	432
Adjusted R^2	.022	.065	.021	.134

Note. Robust standard errors are presented in parentheses. Data come from the 2005 Land Trust Alliance survey of trusts. Observations included are those inferred to have responded to all of the relevant questions. The indicator for the first PCons quartile equals 1 for states that were in the lowest quartile (25th percentile) for the price of conservation, averaged over 2000–5. All price calculations assume a qualified farmer or rancher with $100K AGI, and easement donation of $500K, and capital gains tax exposure of $250K absent the donation.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

age acquired by bargain sale, while controlling for trust size. The residual category—purchased easements—is omitted. Donation percentage is statistically significant, suggesting that every one-percentage-point increase in a trust's holdings coming from donations (at the expense of purchases, given that bargain sales is held constant) results in a 0.172 reduction in the percentage of land held in a conservation priority area. The effect of shifting one percentage point from purchases to bargain sales has a smaller measured effect. The ordering of coefficients supports the interpretation that donated easements are inferior easements, according to the trust's definition of the term. The positive coefficient on the number of easements held suggests that larger land trusts are better at attracting land in priority areas. Similar results are found in the second column, which weighs the estimates by the size of land trusts.

Columns 1 and 2 of table 8 provide evidence that donated easements are inferior to purchased easements, but they do not tell us if the particular easements induced by tax benefits differ in quality from other donated easements. To probe this issue, we first divide the price of conservation relevant to a trust's prospective donors into quartiles, ranked by the price averaged over 2000 to 2005 from lowest to highest. Next, we create indicator variables for each quartile, which we interact with the percentage of a trust's easements acquired via donation. (For trusts operating in multiple states, the price is averaged across states.) By comparing the coefficients across interaction terms, we assess the sensitivity of the relationship between donated and priority-area easements to the generosity of the tax code.

If trusts in states with low prices of conservation accepted unusually low-quality easements, we should see a larger effect of the "percentage donated" on "percent of easement in priority areas" in those states. If anything, we see the opposite. Column 3 shows statistically significant negative effects of donations on easement quality in all four quartiles (donated easements are inferior to purchased easements), but no more so for trusts in states with the strongest tax incentive (the lowest prices.) The point estimate is the largest in the quartile with the weakest tax incentives.[30] This provides suggestive evidence that tax incentives increase the quality of easement donations, insofar as "quality" is defined by land trusts through their priority areas.[31]

30. Further evidence comes from column 4, in which land trusts are weighted by their acreage held. Column 4 shows insignificant effects of donations on quality for trusts in the three lowest quartiles of the price of conservation. The statistically significant column 4 coefficient of −0.306 for the fourth quartile suggests that donated easements are inferior to purchased easements only in those states whose donors face a high price of conservation.

31. We recognize that "quality" is complex and multidimensional and that it may not be fully characterized by priority areas. For more on measuring the quality of easement donations, see Lawley and Yang (2015).

6. CONCLUSION

Governments have long acted to protect land from development, sometimes through direct acquisition and sometimes through land use regulation (see Glaeser and Kahn 2004; Turner et al. 2014). But less centralized, incentive-based approaches are becoming more common across the globe.[32] The US system of preferential tax treatment toward conservation easements held by local land trusts is a leading example of decentralized conservation. In it, the government's main role is to set tax policy and then let individuals, under limited regulation, determine the quantity and patterns of permanent conservation.

Our analysis informs policy debate about this decentralized method in two ways. First, some critics worry that generous tax policies merely subsidize wealthy landowners and do not change land use decisions. Our tax calculations show that high-income landowners do accrue substantially higher tax benefits from donating when compared to low-income landowners. But the large elasticity estimates, ranging from −2.4 to −6.1, imply that tax incentives have substantial effects on permanent conservation outcomes.

Second, other critics worry that tax-induced conservation leads to ad hoc patterns of land restrictions instead of more valuable coordinated networks of protected land. On this, we find mixed evidence. On the one hand, evidence suggests that trusts accept easement donations outside of conservation priority areas that they would not purchase. On the other hand, there is no evidence that increasing tax incentives leads to a greater proportion of easements outside of priority areas.

Our analysis raises questions about the limits of decentralized, private conservation and how its performance compares with centralized, government approaches.[33] Although a full comparative analysis is outside the scope of the current study, this is an important topic, especially because direct government conservation may crowd out (or crowd in) private conservation (Albers et al. 2008; Parker and Thurman 2011). Moreover, we do not investigate incentives to cheat (Kleven et al. 2011) by exaggerating easement values. Evidence from other settings indicates that lax oversight can encourage exaggerated claims of charitable giving (Fack and Landais 2016). In our setting, increasing Internal Revenue Service oversight over fraudulent easement appraisals may decrease the responsiveness of easement donations to tax incentives. We leave this important issue for future research.

32. Many governments are now paying landowners to voluntarily refrain from making land use changes through incentive-based programs (Salzman 2005; Jack et al. 2008; Alix-Garcia et al. 2016).

33. It is an empirical question if conservation networks accrued through the land trust system of relying on tax donations differ from centrally planned networks that may be chosen by a public or private organization with a large budget for purchasing land; see Costello and Polasky (2004) and Newburn et al. (2006).

REFERENCES

Albers, Heidi J., Amy W. Ando, and Xiaoxuan Chen. 2008. Spatial-econometric analysis of attraction and repulsion of private conservation by public reserves. *Journal of Environmental Economics and Management* 56 (1): 33–49.

Alix-Garcia, Jennifer M., Katharine R. E. Sims, and Patricia Yañez-Pagans. 2016. Only one tree from each seed? Environmental effectiveness and poverty alleviation in Mexico's payments for ecosystem services program. *American Economic Journal: Economic Policy* 7 (4): 1–40.

Andreoni, James. 1990. Impure altruism and donations to public goods: A theory of warm-glow giving. *Economic Journal* 100 (June): 464–77.

Auten, Gerald, Holger Sieg, and Charles Clotfelter. 2002. Charitable giving, income and taxes: An analysis of panel data. *American Economic Review* 92 (1): 371–82.

Backus, Peter G., and Nicky L. Grant. 2016. Consistent estimation of the tax-price elasticity of charitable giving with survey data. Working Paper, University of Manchester.

Baker, George. 2002. Distortion and risk in optimal incentive contracts. *Journal of Human Resources* 37 (4): 728–51.

Bakija, Jon M. 2009. Documentation for a comprehensive historical U.S. federal and state income tax calculator. Williams College.

Bakija, Jon M., William G. Gale, and Joel B. Slemrod. 2003. Charitable bequests and taxes on inheritances and estates: Aggregate evidence from across states and time. *American and Economic Review* 93 (2): 366–70.

Bakija, Jon M., and William M. Gentry. 2014. Capital gains taxes and realizations: Evidence from a long panel of state-level data. Working Paper, Williams College.

Bakija, Jon M., and Bradley T. Heim. 2011. How does charitable giving respond to incentives and income? New estimates from panel data. *National Tax Journal* 64 (2): 615–50.

Barrett, Kevin S., Anya M. McGuirk, and Richard Steinberg. 1997. Further evidence on the dynamic impact of taxes on charitable giving. *National Tax Journal* 50 (2): 321–34.

Boyd, James, Kathryn Cabellero, and R. David Simpson. 2000. The law and economics of habitat conservation: Lessons from an analysis of easement acquisitions. *Stanford Environmental Law Journal* 19 (January): 209–55.

Bray, Zachary. 2010. Reconciling development and natural beauty: The promise and dilemma of conservation easements. *Harvard Environmental Law Review* 34:119–77.

Burbidge, John B., Lonnie Magee, and A. Leslie Robb. 1988. Alternative transformations to handle extreme values of the dependent variable. *Journal of the American Statistical Association* 83 (401): 123–27.

Chetty, Raj, Adam Looney, and Kory Kroft. 2009. Salience and taxation: Theory and evidence. *American Economic Review* 99 (4): 1145–77.

Chetty, Raj, and Emmanuel Saez. 2013. Teaching the tax code: Earnings responses to an experiment with EITC recipients. *American Economic Journal: Applied Economics* 5 (1): 1–31.

Costello, Christopher, and Stephen Polasky. 2004. Dynamic reserve site selection. *Resource and Energy Economics* 26:157–74.

Dana, Andrew C., and Michael Ramsey. 1989. Conservation easements and the common law. *Stanford Environmental Law Journal* 8 (2): 2–45.

Eagle, Josh. 2011. Notional generosity: Explaining charitable donors' high willingness to part with conservation easements. *Harvard Environmental Law Review* 35:47–90.

Fack, Gabrielle, and Camille Landais. 2016. The effect of tax enforcement on tax elasticities: Evidence from charitable contributions in France. *Journal of Public Economics* 133:23–40.

Feenberg, Daniel R., and Elizabeth Coutts. 1993. An introduction to the TAXSIM model. *Journal of Policy Analysis and Management* 12 (1): 189–94.

Feldstein, Martin. 1975. The income tax and charitable contributions: Part 1, Aggregate and distributional effects. *National Tax Journal* 28 (1): 81–100.

Glaeser, Edward L., and Matthew Kahn. 2004. Sprawl and urban growth. In *Handbook of regional and urban economics*, ed. V. Henderson and J. Thisse. 4:2481–2527. London: Elsevier.

Halperin, Daniel. 2011. Incentives for conservation easements: The charitable deduction or a better way. *Law and Contemporary Problems* 74:29–50.

Hungerman, Daniel M., and Mark Ottoni-Wilhelm. 2016. What is the price elasticity of charitable giving? Toward a reconciliation of disparate estimates. Working Paper, University of Notre Dame.

Jack, B. Kelsey, Carolyn Kousky, and Katharine R. E. Sims. 2008. Designing payments for ecosystem services: Lessons from previous experience with incentive-based mechanisms. *Proceedings of the National Academy of Sciences* 105 (28): 9465–70.

Kleven, Hendrik Jacobsen, Martin B. Knudsen, Claus Thustrup Kreiner, Søren Pederson, and Emmanueal Saez. 2011. Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark. *Econometrica* 79 (3): 651–92.

Korngold, Gerald. 1984. Privately held conservation servitudes: A policy analysis in the context of gross real covenants and easements. *Texas Law Review* 63 (3): 433–96.

Kotchen, Matthew J. 2006. Green markets and private provision of public goods. *Journal of Political Economy* 114 (4): 816–34.

Lawley, Chad, and Charles Towe. 2014. Capitalized costs of habitat conservation easements. *American Journal of Agricultural Economics* 96 (3): 657–72.

Lawley, Chad, and Wanhong Yang. 2015. Spatial interactions in habitat conservation: Evidence from prairie pothole easements. *Journal of Environmental Economics and Management* 71:71–89.

Looney, Adam. 2017. Charitable contributions of conservation easements. Brookings Institution. www.brookings.edu/wp-content/uploads/2017/05/looney_conservationeasements.pdf.

MacKinnon, James G., and Lonnie Magee. 1990. Transforming the dependent variable in regression model. *International Economic Review* 31 (2): 315–39.

Mahoney, Julia D. 2002. Perpetual restrictions on land and the problem of the future. *Virginia Law Review* 88 (4): 739–87.

McLaughlin, Nancy A. 2005. Rethinking the perpetual nature of conservation easements. *Harvard Environmental Law Review* 29:421–521.

Merenlender, A. M., L. Huntsinger, C. Guthey, and S. K. Fairfax. 2004. Land trusts and conservation easements: Who is conserving what for whom? *Conservation Biology* 18 (1): 65–75.

Newburn, David A., Peter Berck, and Adina M. Merenlender. 2006. Habitat and open space at risk of land-use conversion: Targeting strategies for land conservation. *American Journal of Agricultural Economics* 88 (1): 28–42.

Parker, Dominic P. 2004. Land trusts and the choice to conserve land with full ownership or conservation easements. *Natural Resources Journal* 44 (2): 483–518.

———. 2005. *Conservation easements: A closer look at federal tax policy*. PERC Policy Series no. PS–34. Bozeman, MT: Property and Environment Research Center.

Parker, Dominic P., and Walter N. Thurman. 2011. Crowding out open space: Federal land programs and their effects on private land conservation. *Land Economics* 87 (2011): 202–22.

Pidot, Jeff. 2005. Reinventing conservation easements: A critical examination and ideas for reform. Policy Focus Report, Lincoln Institute of Land Policy, Cambridge, MA.

Randolph, William C. 1995. Dynamic income, progressive taxes, and the timing of charitable contributions. *Journal of Political Economy* 103 (4): 709–38.

Rissman, Adena R., Lynn Lozier, Tosha Comendant, Peter Karieva, Joseph M. Kiesecker, M. Rebecca Shaw, and Adina M. Merenlender. 2007. Conservation easements: Biodiversity protection and private use. *Conservation Biology* 21 (3): 709–18.

Salzman, James. 2005. Creating markets for ecosystem services: Notes from the field. *New York University Law Review* 80:870–961.

Soppelsa, Maria Edisa. 2015. Do state tax breaks for land conservation work? University of Illinois Department of Economics Working Paper.

Sundberg, Jeffrey O. 2011. State income tax credits for conservation easements: Do additional credits create additional value? Working Paper, Lincoln Institute of Land Policy, Cambridge, MA.

Sundberg, Jeffrey O., and Richard F. Dye. 2006. Tax incentives for conservation easement donations. *Proceeding from the Annual Conference on Taxation of the National Tax Association* 99:219–24.

Suter, Jordan F., Sahan Dissanayake, and Lynne Lewis. 2014. Public incentives for conservation easements on private land. Working Paper, Colorado State University.

Turner, Matthew A., Andrew Haughwout, and Wilber van der Klaauw. 2014. Land use regulation and welfare. *Econometrica* 82 (4): 1341–1403.

Wolf, Elliott. 2012. Simultaneously waste and wasted opportunity: The inequality of federal tax incentives for conservation easement donations. *Stanford Environmental Law Journal* 31 (2): 101–18.