

Conservation and Externalities: The Effect of Conservation Easements on Neighboring Residential Parcels

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Abstract

This paper estimates the causal effect of conservation easements on property values and taxes of neighboring residential parcels. Conservation easements promote the preservation of open space and restrict development, and their spillover effects on surround property remains unclear. Using a panel dataset of over 550,000 residential parcels in Hennepin County, Minnesota (2005 -2024), this paper examines parcels that sell after a nearby easement is recorded, utilizing sale timing to capture the capitalization in market value and taxes.

Using the staggered difference-in-difference design by Callaway and Sant'Anna (2021), this paper estimates post-sale adjustments in real property taxes, real market value, and the city tax share across parcels located within a 500m, 1500m, and 2500m from an easement. Treated parcels are matched to their nearest easement and restricted to those that sell post-easement. Control parcels are matched within cities of treated parcels outside of the 2500m band.

Results show that residential parcels within 1500m of an easement experience a 1.9 percentage point increase in real property taxes and a 1.0 percentage point increase in real market value. These effects attenuate slightly with distance but remain statistically significant up to 2500m. The effect on city tax shares is mixed but generally show an increase of 0.001 percentage points suggesting a redistribution of the tax burden toward neighboring properties. The event study estimates show that effects emerge within two years of a sale and taper off between 7 to 10 years, depending on distance. Multiple placebo and robustness tests are used to strengthen the

identification strategy. Such tests include a spatial placebo test, where control parcels are randomly assigned to treatment, alternating the nearest matched easement, and utilizing the easement date itself to verify capitalization occurs at sale and not from the easement timing itself.

This study contributes to the literature by utilizing the staggered difference-in-difference model, integrating the effects of distance, and incorporating sales to capture realization. This paper demonstrates that conservation easements produced localized fiscal effects that are realized upon sale. These findings have implications for local government pertaining to the tradeoffs between land use and municipal finances. This study finds that while conservation easement help to preserve the environment, they also cause spillover effects that alter housing markets and redistributes taxes across parcels.

Introduction

Conservation easements are agreements to permanently restrict development rights on privately owned land to preserve open space and protect ecological resources. While the direct effects of easements on the conserved parcels are understood, the current research has attempted to understand how conservation easements effect neighboring parcels. The evidence of these effects is limited and does not address endogeneity and timing problems. The research is also generally interested in agricultural land and not that of residential properties.

This paper answers how conservation easements impact property values and taxes of neighboring parcels by focusing on those that experience a sale after the establishment of a nearby easement. Building off of the research on open space, I hypothesize that conservation easements have a similar amenity appeal and therefore must impact property values and taxes of nearby properties. However, my study hypothesizes that the effects of easements on neighbors are only realized upon sale, when values are reassessed, and the lack of future development nearby are realized into the market value and taxes of neighboring parcels.

The study of conservation easements is closely linked to the research on open space and property values. For example, Vandegrift and Lahr (2011) using repeated sales to estimate the effect of publicly acquired open space on housing prices. Using data from New Jersey municipalities they find that open space can increase local housing prices over time. However, they also find that the effects are potentially offset slightly due to the removal of land from taxation. Chamblee et al. (2011) use cross sectional data and find positive spillovers from conservation easements on nearby land prices using a hedonic pricing model in North Carolina. They find that neighboring parcels experience a roughly 46% average increase in land value that tapers off with distances from the conserved parcel.

Other research has focused more on tax effects. Kalinin et al. (2023) use panel fixed-effects models on over 1,400 municipalities across New England from 1990 to 2015. Using the share of land under protection for each municipality they find that protected land has minimal effects on local property tax rates. They find that a 1 percentage point increase in protected land correlates to a \$1.16 per \$100,000 of value for 100 acres of new land protection. Yoo and Ready (2016) incorporate spatial methods into their hedonic price models of Pennsylvania farmland easements using geographically weighted regressions. In general, they find that proximity to protected land raises home values, however in some contexts they find easements may have a negligible or even negative impact which they believe is due to development pressures. These studies highlight that conservation easements often appreciate property values. Additionally, easements may reduce the tax base, those lost revenues are often made up by surrounding property, shifting the share of the tax burden onto neighboring properties. The research typically uses cross-sectional or panel models and do not utilize the more recent causal inference methodologies, potentially increasing the risk of biased estimates. They also do not explore the relationship of timing of an easement or sales of nearby property. Lastly, multiple outcome variables are generally not incorporated together such as comparing increases in market value, taxes, and the share of the overall city tax burden. This study makes several contributions to the literature by applying newer methods, integrating more outcome variables, and leveraging sales of neighboring properties to isolate capitalization effects.

My analysis builds on prior research in two fundamental ways, I consider parcels within distance bands of 500 meters, 1500 meters, and 2500 meters as exogenously treated, because these parcels do not willingly choose to have an easement placed nearby. I also restrict my analysis to parcels that sell after the easement is in place, emphasizing the timing of capitalization.

Second, I estimate multiple event-study models using the distance bands to highlight the dynamic effects that proximity of easements have on property outcomes. Third, I ensure that the control group includes only residential parcels that also sold around the same time. This mitigates the potential bias of comparing sold parcels to unsold ones. Fourth, unlike most studies that focus solely on sale price, I estimate effects on real property taxes and tax shares, providing insight into broader fiscal impacts. Lastly, I conduct a series of varying types of robustness checks including placebo tests using the easement dates as treatment timing, a spatial placebo test randomizing locations, and varying the assigned easement match. I find from these tests that randomly reassigned easement dates and locations show no effects on outcomes and that the influence of an easement declines as the match becomes more distant.

The results show that residential parcels located within 1500 meters of a newly established conservation easement experience a 1.9 percentage point increase in real property taxes after a sale, relative to sold parcels in the same city that are not near any easement. Real market values rise by about 1.00 percentage point and the effects attenuate with distance but remain statistically significant up to 2500 meters. The findings indicate that conservation easements not only have the ability to preserve land but also impact local property values and tax burdens

The paper proceeds as follows. Section 2 provides background on conservation easements and the theoretical mechanisms for spillover effects. Section 3 describes the data and variables used. Section 4 outlines the empirical strategy. Section 5 presents the main results, including aggregate and dynamic effects. Section 6 discusses robustness checks and validation. Section 7 interprets the findings, explores policy implications, and concludes the paper.

Background and Theoretical Motivation

Conservation easements are legal agreements between private landowners and governments that restrict the development of land to preserve it. These agreements tend to be permanent and do not always require public acquisition. The direct benefits of conservation easements include preservation of natural resources, ecological protection, and environmental advantages (Byers et al., 2005). However, there are also broader indirect economic impacts that spillover to neighboring properties and effect municipal finances.

In theory, conservation easements create spatial positive externalities by preserving open space and enhancing environmental and ecologic protections. Through the preservation of open space, easements may increase the demand for the surrounding areas. This increased demand is most likely capitalized in property values and taxes at the point of sale. Therefore, easements are assumed to act similarly to open spaces such that they are a local amenity that preserves views, reduces noise or traffic in an area, and maintains the environment, all of which are capitalized in higher market values and taxes.

However, capitalization is assumed to not spread evenly across a municipality but is instead a function of proximity to an easement. Those closer to an easement will experience the appreciation of home values and taxes more than those further away. These capitalization effects are observed at the point of sale, when the market realizes the expectations of future land use in a buyer's willingness to pay and the property is reassessed. This hypothesis is driven by two factors. First, assessors in Minnesota are not permitted to account for an easement on a property. Second, Minnesota has a tax capacity system, whereby each year the local governments determine their annual budgets and then set property tax levies to raise the required revenue (Minnesota Department of Revenue, 2021). For example, if a local municipality requires

\$1,000,000 in revenue, taxes are allocated across properties based on their property type and value. Therefore, it is reasonable to assume that capitalization happens through the market at the point of sale, rather than through reassessment triggered by the presence of an easement. This is supported by findings in this paper, which shows no evidence that the introduction of an easement directly causes reassessment of neighboring property values and taxes.

Lastly, under Minnesota's tax capacity system, any loss in revenue must be redistributed among other properties to meet revenue targets. This paper hypothesizes that due to a property entering an easement, its value and tax contributions decline, thus shifting the burden onto neighboring properties. This shift is most likely to occur after a sale of a neighboring property when reassessment of the property occurs.

Therefore, this paper hypothesizes that neighboring properties will experience increased market values and higher tax burdens following a sale. Those increases are also a function of distance such that properties closest to the easement may have a higher increase compared to those further away. These higher tax burdens are partly due to the market adjusting for the easement premium and also from the redistribution of taxes from the easement property to the adjacent neighbors.

Data and Descriptive Statistics

This study uses a panel dataset of residential parcels in Hennepin County, Minnesota, spanning from 2005 to 2024. The dataset joins parcel-level tax records with conservation easements to estimate the causal impact of conservation easements on neighboring properties. For each parcel-year observation the data includes estimated market value, estimated city property taxes, city property tax share, homestead status, date of sale, city, watershed district, and school district. The tax data for this analysis was provided by the Hennepin County Tax Assessors office and the Minnesota Geospatial Commons. Information on easements were collected through the Hennepin County Land and Water Unit, Minnesota Land Trust and Minnehaha Creek Watershed District.

Constructing the dataset consisted of matching easements to the county parcel tax records using unique identification numbers for each parcel by year. Doing so, allowed for the utilization of the parcel geometries by year and spatially construct a dataset to later define treatment and control groups. Through this process all parcel geometries are converted to centroids and a 2,500 meter buffer is casted around each easement. Parcels that fall within an easement's buffer are assigned to that easement creating a dataset where some parcels are linked to multiple easements. Each parcel-easement pair is then ranked by proximity and retain only the treated parcels that are closest to an easement.

To enhance the validity of comparing the two groups, I then further constrain the treatment assignment in two ways. First, only neighboring parcels within the same city are matched to the easement parcel. Secondly, I remove any treated parcel that sells prior to an easement. Naturally, sales will reassess the value of a property, however, this study is particularly focused on the easement premium. Therefore, the treatment groups consists of

parcels that sold after the establishment of the match easement. The control group is comprised of parcels that sold during the same period in the same city but were not located within the easement buffer.

Figure 1. Distribution of Sales by Year by Treatment Group

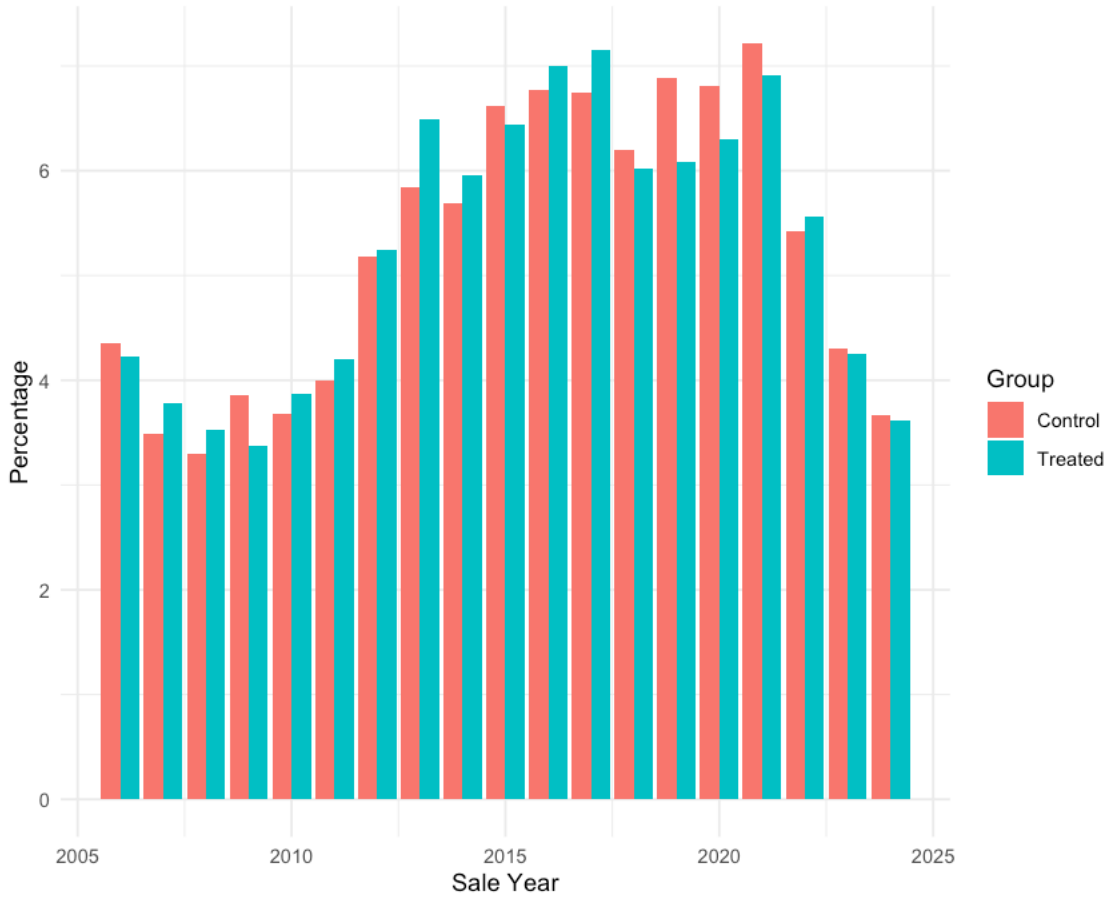


Figure 1 presents the distribution of sale years by treatment group. Although there are minor fluctuations by year, sales are generally balanced across groups and time. For example, of all the parcels in the control group that had a sale, 5.18% had their sale year in 2012, while 5.24% of the treatment group was sold in that same year. This approach ensures that comparisons are drawn across similar observations experiencing relatively similar market environments.

Table 1. Data Descriptions for Selected Variables

Variable	Descriptions
Real Property Taxes	Inflation-adjusted sum of land and building taxes paid to the city in a given year, log-transformed.
Real Estimated Market Value	Inflation-adjusted estimated total market value of land and buildings for a parcel in a given year, log-transformed.
City Tax Share	Parcel's share of total city property tax revenue in a given year (percent)
City	Municipality in which the parcel is located (categorical)
Watershed	Watershed district in which the parcel is located (categorical).
School District	School district in which the parcel is located (categorical).
Homestead Status Change	Indicator for whether the parcel ever entered or exited the homestead exemption program.

Table 1 summarizes each variable used in the models along with their transformations. The primary outcome variables include real property taxes, real estimated market value, and city tax share. Both real property taxes real estimated market value are inflation-adjusted to 2005 dollars using the Bureau of Labor Statistics Consumer Price Index (U.S. Bureau of Labor Statistics, n.d.) and log-transformed (with a +1 adjustment) to normalize the outcome variables without dropping zero values and interpret as percentage changes. The city tax share is defined as the percentage of total city property tax revenue is attributable to a parcel within a given year. The additional controls include the city of a parcel, watershed district, and the school district. Cities such as Roger, Orono, Greenfield, and Saint Louis Park are grouped together due to their low number of treated units and labeled as "Other". Lastly, a binary variable, Homestead Status Change, is included to capture whether the parcel has ever entered or exited the homestead exemption program.

Summary Statistics

The tables for the summary statistics are provided in Appendix A. Table A8 - Table A10 present the summary statistics for treated parcels within the 500m, 1,500m, and 2,500m bands from a conservation easement and the control group.

Table A8 shows the treated parcels within the 500m distance band with 24,403 treated observations. Treated parcels have higher real property taxes (\$3,658 vs. \$2,837), estimated market values (\$1.21M vs. \$861K), and city tax share (0.027% vs. 0.008%) compared to control parcels. The distributions between the two groups is also quite different. Treated parcels have higher standard deviations in market value (SD: \$1.22M vs \$863K), lower maximum property taxes (\$69,609 vs \$94,314), and nearly a third lower maximum city tax share (0.698% vs 0.089%) compared to the control group. The treated group is more highly concentrated in cities such as Medina, Minnetonka, and Other while the control group is more concentrated in Bloomington, Golden Valley, and Maple Grove.

Table A9 shows the treated parcels within the 1,500m distance band with 149,344 treated observations. The patterns are similar to the 500m grouping. Treated parcels have higher real property taxes (\$3,406 vs. \$2,837), estimated market values (\$1.10M vs. \$861K), and city tax share (0.019% vs. 0.008%) compared to control parcels. The median, standard deviation, minimum and maximum present similar patterns as the 500m distance band but less generally skewed. The city controls are slightly more balanced but still present a similar pattern.

Table A10 presents the treated parcels within the 2,500m distance band with 330,025 treated observations. The differences between groups is the smallest at this distance. Treated parcels still have higher real property taxes (\$3,129 vs. \$2,837), estimated market values (\$995K vs. \$861K), and city tax share (0.015% vs. 0.008%) compared to control parcels. Median values

and standard deviations also converge indicating that the treated and control groups become more similar at this scale. The distribution across all control variables becomes much more balanced compared to shorter distance bands.

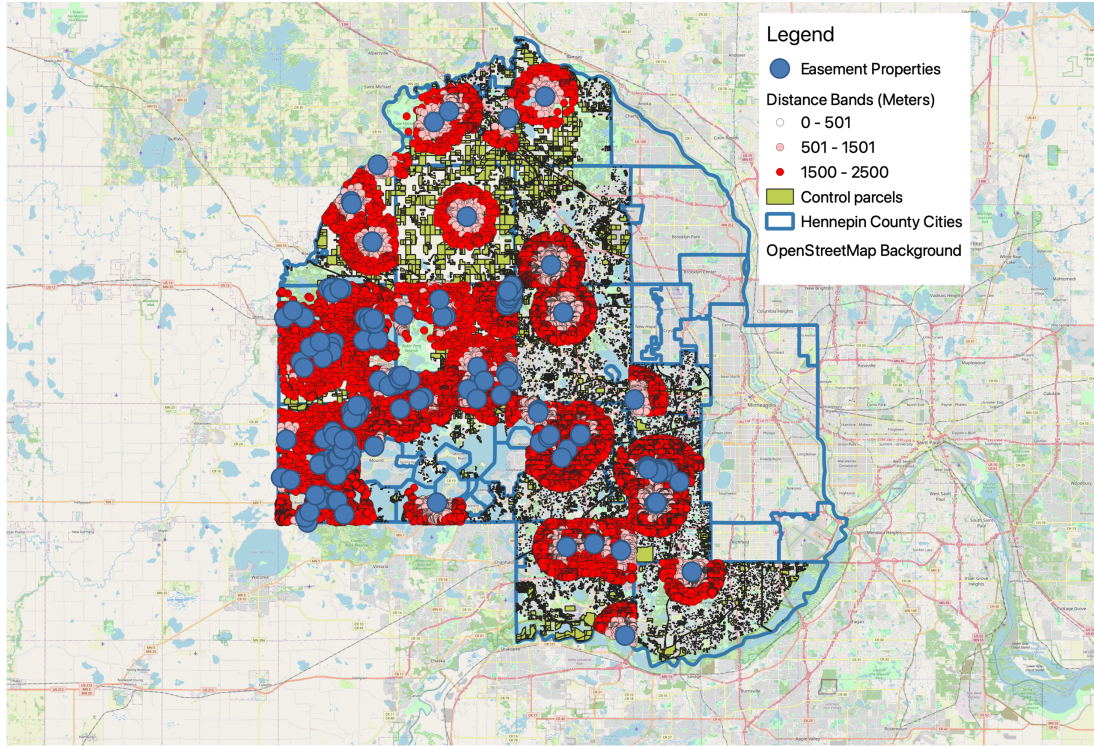
These tables suggest that parcels sold near conservation easements tend to have higher value and tax obligations compared to the control parcels in the same city. These differences may highlight the hypothesis that closer proximity to an easement may increase property values and tax obligations. They tables also underscore the importance of controlling for city, watershed, school district, and homestead changes.

Empirical Strategy

This paper estimates the effect of nearby conservation easements on the property values and taxes of residential parcels that sell after the easement is placed nearby. The treatment group consists of residential parcels that are located within a specified distance (500m, 1500m, and 2500m) of an established conservation easement. This design is utilized because realization of the effects do not happen until a sale occurs, given that tax reassessments and market corrections of the property occur after the sale. The control group includes residential parcels in the same city that also sold but are not located within the treatment boundary at the time of sale.

Figure 2 is a map presenting the treatment groups and control parcels within each city (blue polygons) in Hennepin County, Minnesota. The treatment group is defined by their distance from an easement: less than 500m (white), 501-1500m of (pink), and 1501-2500m (red). While the visual bands appear as concentric buffers, the treatment assignment includes all parcels within the specified threshold such as all parcels within the 1500m for the 1500 meter band. In most cases, the treatment groups do not form perfect circles, because they are constrained by municipal boundaries. The boundary constraint ensures that treatment comparisons occur within the same city, because cities have varying tax structures and governance. The yellow polygons are all eligible control parcels. Given that the models use a doubly robust estimation method not all parcels ultimately join the control group. The blue dots are easement properties.

Figure 2. Spatial Distribution of Treated, Control, and Neighboring Parcels by Distance to Easement Parcels



To estimate the effect of conservation easements on neighboring properties I implement a staggered difference-in-differences design using the event-study framework developed by Callaway and Sant’Anna (2021). This approach leverages the variation in treatment timing (sales) across neighboring parcels and estimates post-treatment effects relative to the timing of the sale. The event-study model is specified as follows:

$$y_{it} = a_i + \lambda_t + \beta_k \times \sum_{k=-17}^{17} D_k(gt) + X_i + \varepsilon_{it}$$

Where y_{it} represents an outcome for parcel i at time t . Outcomes include logged real city level taxes, logged real estimated market value, and tax share of city. Parcel fixed effects a_i control for time-invariant heterogeneity, and year fixed effects λ_t absorb general time varying macroeconomic effects across parcels. The indicators $\sum_{k=-17}^{17} D_k(gt)$ denote event time relative

to treatment. k ranges from -17 to 17. X_i are vectors of time invariant controls for a parcel including city, watershed, school district, and whether or not the parcel joined or left a homestead. I utilize the doubly robust estimator from Callaway and Sant'Anna (2021) to ensure that the model is comparing groups effectively.

Additionally, I estimate a series of varying placebo tests which can be found in Appendix C. First test is a spatial placebo test where treatment is randomly assigned to control parcels, matching the original number of treated parcels by municipality within a given year. For example, if the City of Corcoran has five treated parcels in 2015, I randomly assign 5 control parcels to treatment within 2015, dropping the true treated parcels from the data. I run a Monte-Carlo of 25 simulations, estimating the aggregate ATT each time. The distributions of the Monte Carlo simulations with the true ATT plotted of outcome variable by distance band is available in Appendix C.

Second, because many cities contain multiple easements established at different times, a given neighboring parcel may be assigned to more than one easement parcel and thus eligible for multiple treatment assignments. In the main analysis, each neighbor is assigned to its nearest easement (choice ranking = 1). To verify that the ranking of a parcel does not significantly affect the outcome, I conduct a sensitivity test by reassigning neighbors to more distant easements, specifically, the 5th and 10th closest easements. Although this test is similar to varying the distance threshold it is an important step in verifying that treatment effects attenuate by easement rank so that the effects of other nearby easements are not significantly altering the results.

Lastly, I test easement timing itself on neighboring parcels. Instead of using the neighboring parcels' sale date I use the date the easement was recorded. This test verifies the hypothesis that property values and taxes are realized at the point of sale and not prior. These

strategies are utilized to strengthen the causal claim of spillover effects of conservation easements on neighboring property values and taxes.

Results

This section presents the estimated effects of conservation easements on neighboring parcels real property taxes, estimated market value, and the parcel's share of total city taxes. I report the average treatment effects on the treated for parcels within 500, 1500, and 2500 meters from an easement using both with and without covariates. I then present event study plots.

Aggregate ATTs

Table 2 through Table 4 report the ATT estimates by distance for each outcome. The results show that the effect of conservations easements are generally statistically significant and attenuated by distance. The covariant adjusted models include city, school district, watershed district, and whether or not that parcel had entered or left a homestead.

Table 2. Aggregate ATT Real Property Taxes

Distance & Covariates	ATT	Std. Error	95% CI Lower	95% CI Upper	
500m (No Cov.)	0.029	0.014	0.001	0.056	*
500m (Cov.) ¹	0.027	0.014	0.000	0.054	
1500m (No Cov.)	0.025	0.005	0.015	0.035	*
1500m (Cov.) ¹	0.019	0.005	0.010	0.028	*
2500m (No Cov.)	0.031	0.004	0.024	0.038	*
2500m (Cov.) ¹	0.020	0.003	0.014	0.027	*

¹ Covariate-adjusted models include fixed effects for city, school district, watershed district, and a binary indicator for homestead change

* Statistically significant at the 5% level

Table 2 shows that property taxes increase the closer a parcel is to a conservation easement. Within the covariate adjusted models, the ATT within the 1500 meter band corresponds to a 1.90 percentage point increase in real property taxes, all else equal. The ATT within the 2500 meter band is roughly the same with a corresponding effect of 2.00 percentage point increase in real property taxes. Using the summary statistics from Table A8, Table A9, and Table A10 we can interpret the average effect in real dollars. Given the average treatment groups real taxes for the 1500 and 2500 meter bands are \$3,406 and \$3,129, respectively, a 1.90 and

2.00 percentage point effect implies a roughly \$62.60 to \$64 average annual increase in real taxes post-sale.

The 500 meter band is not statistically significant most likely due to its smaller sample size. However, given the non-covariate adjusted model shows a decrease in the ATT as distance increases and the 1500 and 2500 meter bands are quite similar in the covariate adjusted model, we can speculate that the effect on real property taxes attenuates over distance even within the adjusted model.

Table 3. Aggregate ATT Real Estimated Market Value

Distance & Covariates	ATT	Std. Error	95% CI Lower	95% CI Upper	
500m (No Cov.)	0.012	0.010	-0.008	0.032	
500m (Cov.) ¹	0.013	0.010	-0.006	0.031	
1500m (No Cov.)	0.009	0.003	0.002	0.015	*
1500m (Cov.) ¹	0.010	0.003	0.004	0.016	*
2500m (No Cov.)	0.011	0.002	0.007	0.015	*
2500m (Cov.) ¹	0.012	0.002	0.008	0.016	*

¹ Covariate-adjusted models include fixed effects for city, school district, watershed district, and a binary indicator for homestead change
 * Statistically significant at the 5% level

Table 3 presents the aggregate ATT estimates on real estimated market value. The effects are similar to that of real property taxes with the 500 meter distance bands not statistically significant. The 1500 meter distance band finds a 1 percentage point increase in property values while the 2500 meter band finds a 1.2 percentage point increase in property values, all else equal. These effects correspond to mean real market values of \$1,096,140 (1500m) and \$995,092 (2500m), which can be adjusted using the effects above to correspond to a \$10,961.40 and \$11,941.10 average annual increase in real market value. The results of Table 2 and Table 3 show notable increases in real taxes and mild increases in real property values. The effect sizes indicate that the increase in taxes and property values are not proportional in percentage point increases. This may indicate that the adjustments of property values and taxes differ or that

municipalities may be more aggressive in adjusting taxes relative to property value increases in order to capture a greater proportion of the tax increase.

Table 4. Aggregate ATT City Tax Share

Distance & Covariates	ATT	Std. Error	95% CI Lower	95% CI Upper	
500m (No Cov.)	-0.001	0.001	-0.004	0.002	
500m (Cov.) ¹	0.001	0.001	-0.001	0.004	
1500m (No Cov.)	0.000	0.000	-0.001	0.000	*
1500m (Cov.) ¹	0.001	0.000	0.000	0.001	*
2500m (No Cov.)	0.000	0.000	0.000	0.000	
2500m (Cov.) ¹	0.000	0.000	0.000	0.001	*

¹ Covariate-adjusted models include fixed effects for city, school district, watershed district, and a binary indicator for homestead change

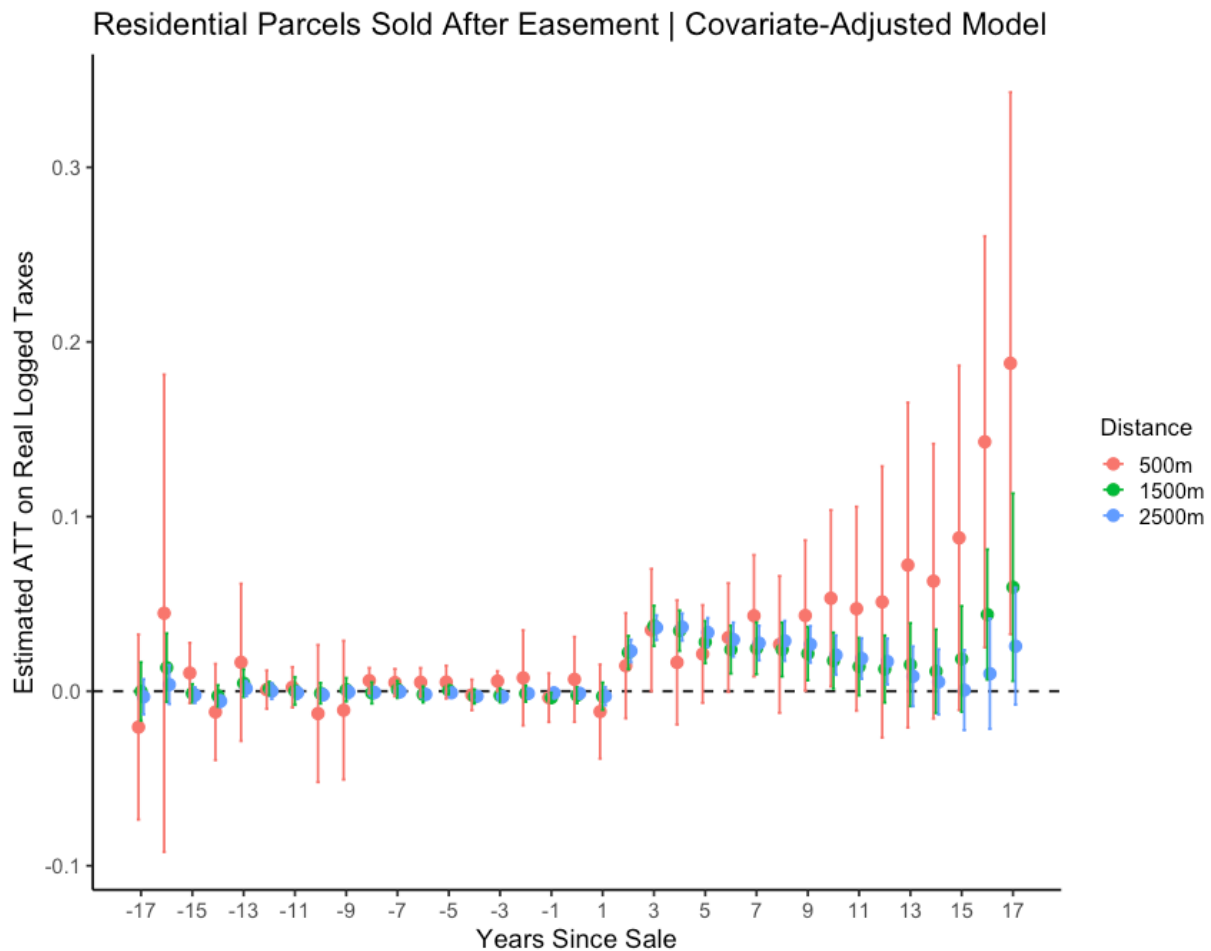
* Statistically significant at the 5% level

Table 4 presents the aggregate ATT estimates on city tax share. The effects are quite different and much smaller compared to Table 2 and Table 3. In general, the model shows that for the treated groups there is a small, 0.001 percentage point increase, and statistically significant increase in the tax share. The effect sizes may seem small, however, the 1500m distance band has a mean tax share of 0.019%, therefore a 0.001 percentage point increase corresponds to a 5.3% increase in the tax share for that group. This indicates that both property tax and the tax share increases for nearby neighboring parcels and that redistribution of the tax base does occur. This may be another example of municipalities capturing the post-sale tax premium. By redistributing tax shares, municipalities are able to capture the premium and utilize the temporary growth boost in revenue.

Event Study Results

Figure 3 - Figure 5 plot the event study estimates for real property taxes, real estimated market value, and city tax share across treated parcels within 500m, 1500m and 2500m bands. Each figure displays the covariate adjusted results of the outcome variable by distance band. The full tables of results are available in Appendix B.

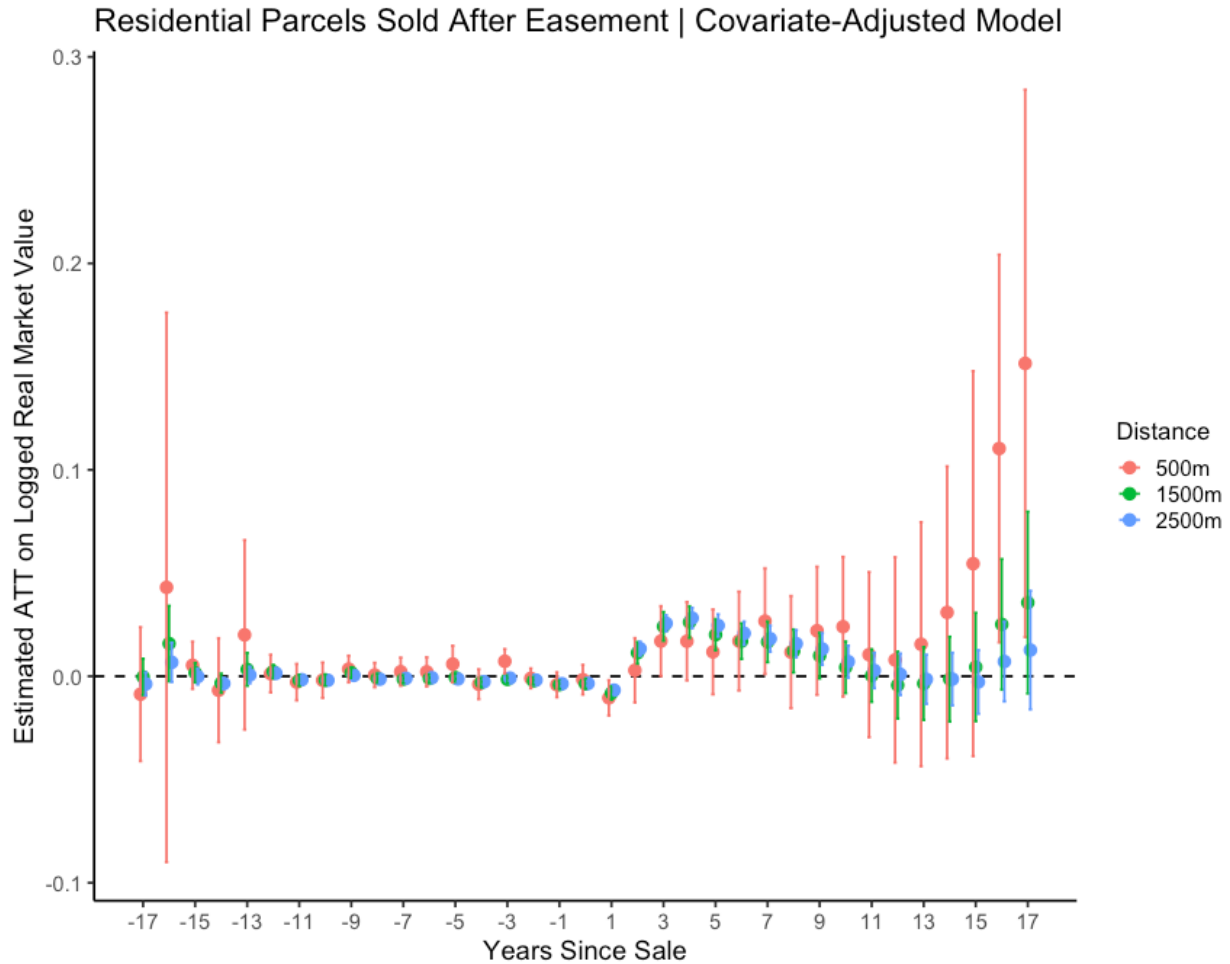
Figure 3. Event Study: Impact of Conservation Easements on Real Property Taxes



Real property taxes (Figure 3) show no significant differences between treated and control parcels in the years prior to the sale across all distances, supporting the parallel trends assumption. In year 2 of post-sale, treated parcels within 1500m and 2500m of an easement show statistically significant increases in taxes and decline over time. In year 5, the effects rise to approximately 2.80 percentage point (1500m) to 3.40 percentage point (2500m). The decline in effect size after year 5 may indicate a “pricing in” of the easement as an amenity, after which the treated parcels no longer appreciate at a faster rate than the control parcels, narrowing the tax differential over time. The 500m buffer also shows positive effects after year 2, though estimates are less stable and not always statistically significant. These results highlight that conservation

easements increase the tax burden on nearby parcels and those effects vary depending on distance.

Figure 4. Event Study: Impact of Conservation Easements on Real Market Value

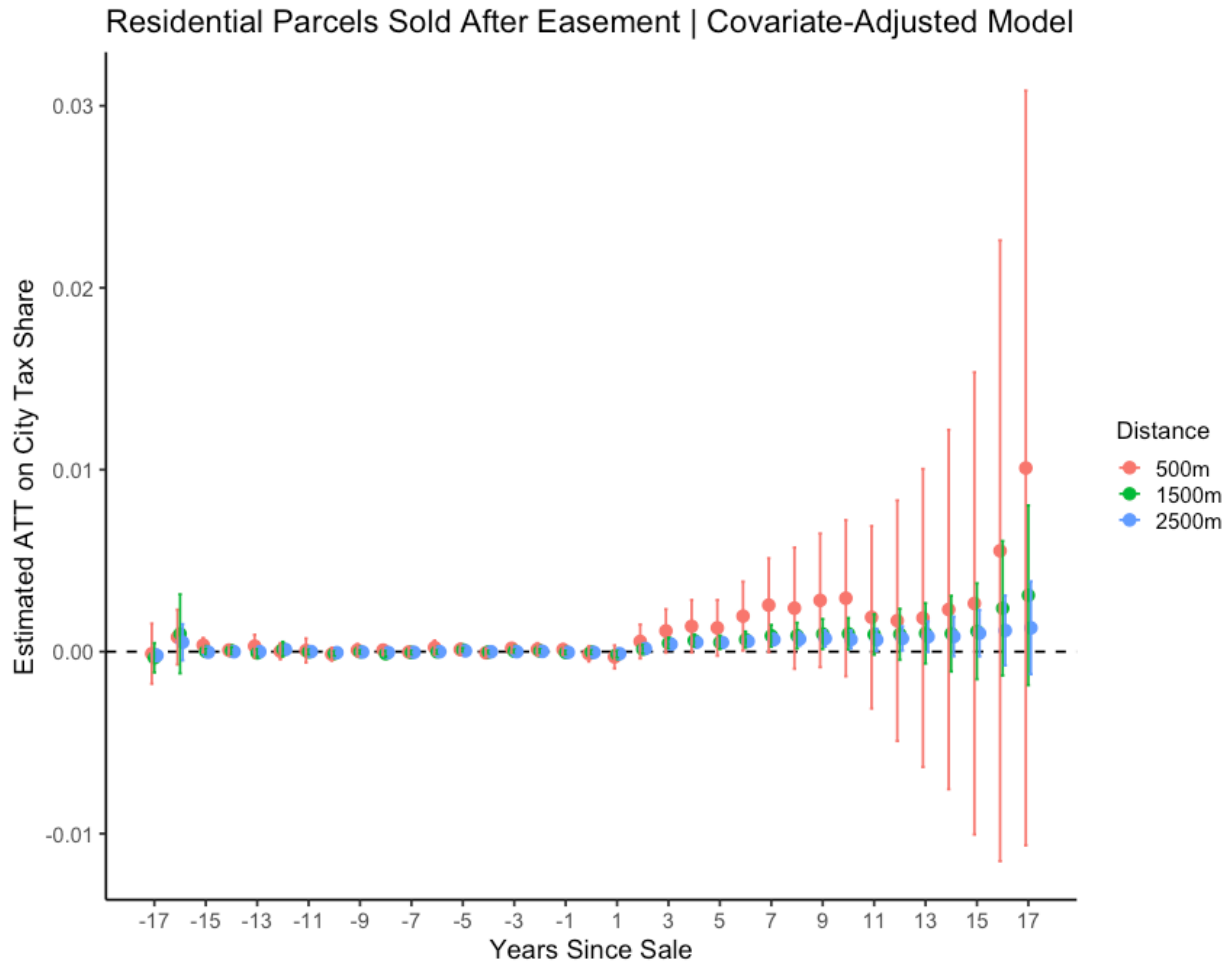


Real estimate market value (Figure 4) presents a similar pattern to Figure 3. While most pre-treatment years appear relatively stable, a small but statistically significant decline in market value is observed in the two years immediately preceding the sale (years -2 and -1) at the 1500 and 2500 meter bands. This may reflect slight violations of the parallel trends assumption or potential anticipatory effects. However, the magnitudes are modest, and the consistent post-treatment increases suggest the main effects are not driven by pre-trend bias. It may also indicate

that market values are more exposed by cross-city variations compared to property taxes. For all distance bands market value increases significantly in year 2. The 1500 and 2500 meter bands experience increases in effects ranging from 1.1 percentage point to 2.8 percentage point by year 5. The effect then becomes not statistically significant after year 10. The 500 distance band follows an immediate upward trajectory around year 2, followed by a plateau, and then a rapid increase upward in the later years. Most years are not statistically significant in distance band 500 but some still are such as years 3, 4 (1.7 percentage point), 7 (3.0 percentage point), and the later years 16 (8.6 percentage point) and 17 (13.5 percentage point). The size of the effect may be due to the smaller sample size of the 500 band but may also be due to proximity.

The results of Figure 3 and Figure 4 show how the dynamic effects of post-sale easement effects. In Table 2 and Table 3 these effects are aggregated highlighting the simpler pre vs post change between the control and treated groups. The results highlight that the aggregate increases (Table 2 and Table 3) in taxes and property values happen early and taper off. This tapering off may indicate a pricing in of the amenity but also may indicate that municipalities are unable to continue to capture the premium tax increase. Other factors may include the densification of municipalities overtime assisting in the redistribution of taxes away from neighboring parcels and allocating them toward newer developments. These factors are further identified in Figure 5.

Figure 5. Event Study: Impact of Conservation Easements on City Tax Share



For city tax share (Figure 5), the effects are smaller, but the pattern is consistent. Parcels near easements begin contributing more following the treatment year. Effects become statistically significant by year 3 for all groups and for the 1500m and 2500m groups they effects continue with increases of roughly 0.01 to 0.03 percentage points. These findings suggest that easements may slightly shift the relative tax burden toward nearby residential parcels and adjust the general tax distribution. Tax redistribution is further evidence that municipalities may be capturing the immediate tax premiums of neighboring parcels. This may be due to the fact that that the increase in property taxes is not proportional to the increase of tax share across years and that the city tax share dynamic effects are no longer statistically significant around year 7-10

depending on the distance band. Again, other factors such as densification can also be responsible for this. As municipalities increase the number of parcels and development the share of taxes may fall redistributing taxes from the neighbors to the new developments.

Understanding the impact of conservation easements on neighboring parcels is particularly relevant for local governments. Easements remove land from potential development that could theoretically expand the tax base and shift the burden to remaining developable land. While those nearest to a conservation easement tend to experience growth in property taxes and market value following a sale, the growth in city tax share is limited. This may be due to the amount of land that is within an easement compared to the amount of land that is still available for development. This is present in how the effects generally weaken over distance and time indicating a universal appreciation of parcels outside of the treatment and therefore may not significantly alter overall patterns of appreciate and municipal finances.

Robustness and Validation

This section provides results testing the credibility of the findings in the body of the paper. These tests are specifically designed to evaluate the underlying assumptions and identification strategy of the models. Three sets of robustness checks are presented.

First, a spatial placebo test is conducted in which placebo treatments are randomly assigned to untreated parcels, specifically matched to the number of treated parcels within a given city and year. The estimated treatment effects are then compared against the distribution of placebo estimates from repeated simulations. This test verifies that the spatial distribution of results is not driven by random chance of where a sale had taken place.

Second, sensitivity test is conducted based on the easement proximity ranking. When assigning treatment, parcels can fall within the buffer of multiple easements, each treated parcel is assigned to the nearest easement. In this robustness check, treated parcels are reassigned to increasingly distant easements such as the 5th and 10th closest, and then re-estimate effects. The estimated effect attenuates with distance and becomes statistically insignificant or negative. This result confirms the assumption that proximity by ranking matters, and the main findings are not driven by random assignment.

Lastly, this paper explores easement timing directly. This test replaces the sale year of a neighboring parcel with the year an easement was established as the treatment timing for treated parcels. Because some easements exist prior to the earliest year within the data (2005) those treatment groups are not incorporated into this test. The groups remaining are then rerun using the same models as in the main results of the paper. The absence of strong treatment effects in this specification further supports the identification strategy that relies on sale timing as the indicator of post-treatment and distance from easement being the exogenous selection into

treatment. The tests reaffirm that the main results are robust and suggest that the estimated effects are not due to random spatial correlation, ranking, or general sample composition.

Spatial Placebo Tests

The spatial placebo test uses Monte Carlo simulation where control parcels are randomly assigned to treatment. The test is additionally robust in that it specifically matches the number of treated parcels within a given city and year. Because the Monte Carlo simulations are computationally intensive, only 25 simulations are used at this time, producing a distribution of potential ATTs. Future revisions of the paper will incorporate a larger number of simulations. From that distribution, I test the whether the difference between the true ATT and the distribution of the placebo ATTs is statistically significant.

Table 5. Estimated Spatial Placebo Effects by Outcome and Distance Band

Outcome Variable	Distance	True ATT	Mean Placebo ATT	P-Value	
Real Market Value	500	0.013	0.004	0.039	*
Real Market Value	1500	0.010	0.010	0.423	
Real Market Value	2500	0.012	0.009	0.039	*
Real Property Tax	500	0.027	0.004	0.039	*
Real Property Tax	1500	0.019	0.009	0.039	*
Real Property Tax	2500	0.020	0.010	0.039	*
City Tax Share	500	0.001	0.000	0.039	*
City Tax Share	1500	0.001	0.000	0.039	*
City Tax Share	2500	0.000	0.000	0.039	*

* Statistically significant at the 5% level

Table 5 presents the results of the spatial placebo test. For nearly all outcome variables the difference between the estimated ATT is statistically significant compared to the placebo ATTs. For real market value at the 1500 distance band, I find that the difference is not statistically significant compared to the randomly assigned treatment groups. The result suggests that the effect is potentially random. However, the result may be due a small number of

simulations or other underlying spatial heterogeneity effects that may be altering the treatment effect.

Nearest Easement Ranking Test

Table 6 provides the estimated effects of the nearest easement ranking test. This test is used to validate that not only distance to easement has the strongest impact but also through the rank of the easement relative to the neighboring parcels. The ATTs are estimated for the 1st, 5th, and 10th closest easements to their neighbors by outcome variable and distance band.

Table 6. Nearest Easement Outcomes by Distance and Outcome Variable

Ranking	Distance	Outcome	ATT	Std. Error	
1	500	Real Property Tax	0.027	0.014	
1	500	City Tax Share	0.001	0.001	
1	500	Real Market Value	0.014	0.010	
1	1500	Real Property Tax	0.018	0.005	*
1	1500	City Tax Share	0.000	0.000	
1	1500	Real Market Value	0.011	0.003	*
1	2500	Real Property Tax	0.019	0.003	*
1	2500	City Tax Share	0.000	0.000	*
1	2500	Real Market Value	0.013	0.002	*
5	500	Real Property Tax	-0.074	0.036	*
5	500	City Tax Share	-0.002	0.003	
5	500	Real Market Value	-0.083	0.044	
5	1500	Real Property Tax	-0.002	0.013	
5	1500	City Tax Share	0.001	0.001	
5	1500	Real Market Value	-0.009	0.007	
5	2500	Real Property Tax	0.028	0.009	*
5	2500	City Tax Share	0.000	0.000	
5	2500	Real Market Value	0.021	0.004	*
10	500	Real Property Tax			
10	500	City Tax Share			
10	500	Real Market Value			
10	1500	Real Property Tax	-0.078	2592.000	
10	1500	City Tax Share	0.002	349.000	
10	1500	Real Market Value	-0.004	3684.000	
10	2500	Real Property Tax	0.005	0.022	
10	2500	City Tax Share	0.002	0.001	*
10	2500	Real Market Value	0.016	0.012	

* Statistically significant at the 5% level

The results for ranking equal to one is the equivalent to the estimated aggregate ATTs in the body of the paper. In this test, statistical significance at higher ranks indicates that easements further away influence neighboring parcels. Rank five shows that the parcels that are tagged to their fifth closest easement generally do not have statistically significant effects except at the 2500m band. Real property taxes and real market value within the 2500m band at rank 5 experience between a 2.1percentage point to 2.8percentage point increase, respectively. The 2500m distance band is more exposed to a greater number of easements at rank 5 compared to the smaller bands at the same rank. Older easements that are included in the models that pre-date 2005 may have long term influence over neighboring parcels and city finances that are being capture here. At rank 10, the effects are generally not statistically significant and may not be as reliable for some variables. These variables and distances are blank because the effect is not able to be calculated, and others have extremely large standard errors highlighting the difficulty in having a precise measurement when the parcel is far from an easement. As rank increases the number of available parcels to compare against also decreases. This is due to different cities having varying number of easements enter at multiple times. Therefore, as the rank increases the sample available reduces and by rank 10 the sample only has three cities (Independence, Medina, and Minnetrista) to analyze. The models generally find that as the rank and distance increases; easements have a reduced impact on parcels. These patterns generally align with the results that distance to easements are important predictors in effect size and also statistical significance.

Easement Timing Test

This section provides the results for the easement timing test. These models estimate the effect on neighboring parcels by replacing the sale year of a neighboring parcel with the year the conservation easement occurred. This test validates that easement timing itself does not cause changes in the outcome variables and that realization due to sales is the true causal driver.

Table 7. Aggregate ATTs Measuring Effect of Conservation Easement Timing

Distance	Outcome	ATT	Std. Error	
500	Real Property Tax	-0.023	0.022	
1500	Real Property Tax	0.002	0.008	
2500	Real Property Tax	0.007	0.006	
500	City Tax Share	0.000	0.001	
1500	City Tax Share	-0.001	0.001	
2500	City Tax Share	0.000	0.001	
500	Real Market Value	-0.027	0.010	*
1500	Real Market Value	-0.006	0.004	
2500	Real Market Value	0.006	0.003	

* Statistically significant at the 5% level

The estimates in Table 7 isolate the effect of easement timing by excluding property sales from both the treatment and control groups. Sales are excluded so as to not bias the results providing a cleaner interpretation easement timing effects. Across all models, there is generally no statistically significant impact of easement timing on any outcome variable. The only exemption is a 2.7 percentage point decrease in real market value at the 500m distance band. However, this may reflect proximity effects, or the smaller sample size compared to the 1500m or 2500m. Additionally, easement properties may also sell, biasing the effects slightly downward. Future revisions of this paper will attempt to further isolate the timing effect of the conservation easements. However, the findings suggest that easement timing along has little to

no statistically significant effect, supporting the hypothesis that market adjustments are primarily driven at the point of sale rather than easement timing.

Limitations

Despite the contributions made by this paper, there are several limitations. First, the 500m distance band experienced sample size issues which may reduce precision of estimates. Secondly, these results pertain to cities within Hennepin County, Minnesota and the results may not be generalizable to other municipalities that have varying tax structures. Third, due to computation limitations, the Monte Carlo simulations in this draft of the paper rely on only 25 simulations which may limit statistical power. Lastly, this study was not able to fully isolate the effect of easement timing on neighboring properties. While sales were excluded for the treatment groups in the robustness check, sales of easement parcels and neighbors that were excluded may introduce spillover bias to those estimates. Future work will better isolate those effects through the incorporation of spatial modeling and increase the number of simulations to produce more robust estimates.

Discussion and Conclusion

This study finds that conservation easements increase the property taxes, market value, and tax share of parcels within a 2500m boundary. These results are consistent with the hypothesis that conservation easements act in a similar way to open spaces and the value is capitalized into neighboring parcels at the time of sale. The effects are not found when using the easement's placement year as the treatment, reinforcing the role of sale timing. This builds on prior literature highlighting the causal implications of conservation easements and the value in incorporating event studies to identify effects over time. This paper finds that conservation easements produce positive externalities captured in higher property taxes, market value, and share of taxes to the local municipality. These amenities are reflected in market transactions, redistributing taxes those who gain the most from the proximity to the preserved land. These results have implications for land use planning and how local governments can align conservation goals with their fiscal priorities.

This study makes several contributions to the literature. First, it applies the Callaway and Sant'anna (2021) staggered difference-in-differences methodology to model the staggered introduction of easements that could not be done prior without biased estimates. Second, this study models three outcome variables, providing a comprehensive understanding of how easements effect both property owners but also city finances. Third, the study utilizes multiple robustness checks that assist in verifying the causal findings.

While this study focuses primarily on municipalities in Hennepin County, Minnesota, the findings have broader relevance. Many urban counties across the US experience similar tradeoffs between land conservation and growth, often relying on property taxes to fund local services.

The findings in this paper may assist local governments in weighing the tradeoffs between land preservation and fiscal responsibility.

This paper demonstrates the value in combining spatial analysis with causal inference methods to better understand land use policy. By leveraging sale timing and proximity to an easement, this study offers a framework for future research to assess the impacts of land use policies and property related outcomes. These findings underscore the importance in understanding the role in land preservations but also the indirect effects it has to those living next to it.

Appendix A

Summary stats

Table A8. Summary Statistics (Distance < 500 Meters)

	Control	Treated
Real Taxes	Mean: \$2,837 SD: \$2,649 Median: \$2,188 Min: \$0 Max: \$94,314	Mean: \$3,658 SD: \$3,863 Median: \$2,601 Min: \$0 Max: \$69,609
Real Market Value	Mean: \$861,832 SD: \$863,288 Median: \$667,178 Min: \$0 Max: \$39,444,707	Mean: \$1,209,832 SD: \$1,218,651 Median: \$852,000 Min: \$0 Max: \$16,094,358
City Tax Share	Mean: 0.008 SD: 0.020 Median: 0.003 Min: 0.000 Max: 2.089	Mean: 0.027 SD: 0.053 Median: 0.007 Min: 0.000 Max: 0.698
City/Town ¹		
Bloomington	113,399 (21%)	1,225 (5.0%)
Corcoran	7,989 (1.4%)	58 (0.2%)
Dayton	10,610 (1.9%)	0 (0%)
Eden Prairie	56,584 (10%)	2,330 (9.5%)
Edina	50,417 (9.1%)	1,991 (8.2%)
Golden Valley	29,908 (5.4%)	158 (0.6%)
Hanover	109 (<0.1%)	274 (1.1%)
Hopkins	6,306 (1.1%)	463 (1.9%)
Independence	2,158 (0.4%)	1,024 (4.2%)
Long Lake	0 (0%)	735 (3.0%)
Maple Grove	83,678 (15%)	839 (3.4%)
Medina	1,157 (0.2%)	2,334 (9.6%)
Minnetonka	36,452 (6.6%)	2,930 (12%)
Minnetrista	2,877 (0.5%)	1,869 (7.7%)
Other	57,946 (10%)	5,011 (21%)
Plymouth	83,451 (15%)	1,056 (4.3%)
Shorewood	8,359 (1.5%)	668 (2.7%)
Wayzata	666 (0.1%)	1,438 (5.9%)

Homestead Status Change ¹		
0	329,692 (60%)	12,979 (53%)
1	222,374 (40%)	11,424 (47%)
Watershed ¹		
0	70,235 (13%)	2,805 (11%)
1	96,132 (17%)	3,980 (16%)
2	95,257 (17%)	1,860 (7.6%)
3	106,842 (19%)	13,275 (54%)
4	74,309 (13%)	1,302 (5.3%)
7	76,822 (14%)	272 (1.1%)
8	30,374 (5.5%)	909 (3.7%)
9	2,095 (0.4%)	0 (0%)
School District ¹		
11	7,625 (1.4%)	0 (0%)
110	121 (<0.1%)	355 (1.5%)
111	128 (<0.1%)	161 (0.7%)
270	40,803 (7.4%)	1,036 (4.2%)
271	113,379 (21%)	1,225 (5.0%)
272	53,607 (9.7%)	2,330 (9.5%)
273	49,108 (8.9%)	1,743 (7.1%)
276	22,732 (4.1%)	2,366 (9.7%)
277	8,516 (1.5%)	1,657 (6.8%)
278	4,217 (0.8%)	2,367 (9.7%)
279	90,890 (16%)	1,095 (4.5%)
280	1,271 (0.2%)	0 (0%)
281	39,499 (7.2%)	0 (0%)
283	32,613 (5.9%)	3,603 (15%)
284	63,952 (12%)	5,562 (23%)
728	13,900 (2.5%)	56 (0.2%)
877	3,596 (0.7%)	332 (1.4%)
879	1,746 (0.3%)	399 (1.6%)
883	4,363 (0.8%)	116 (0.5%)
	N = 552,0661	N = 24,4031

¹ Values shown reflect the count of observations and their corresponding percentage of the treatment or control group in parenthesis

Table A9. Summary Statistics (Distance < 1500 Meters)

	Control	Treated
Real Taxes	Mean: \$2,837 SD: \$2,649 Median: \$2,188 Min: \$0 Max: \$94,314	Mean: \$3,406 SD: \$3,355 Median: \$2,536 Min: \$0 Max: \$69,609
Real Market Value	Mean: \$861,832 SD: \$863,288 Median: \$667,178 Min: \$0 Max: \$39,444,707	Mean: \$1,096,140 SD: \$1,084,283 Median: \$814,856 Min: \$0 Max: \$23,879,842
City Tax Share	Mean: 0.008 SD: 0.020 Median: 0.003 Min: 0.000 Max: 2.089	Mean: 0.019 SD: 0.045 Median: 0.005 Min: 0.000 Max: 1.147
City/Town ¹		
Bloomington	113,399 (21%)	7,425 (5.0%)
Corcoran	7,989 (1.4%)	496 (0.3%)
Dayton	10,610 (1.9%)	422 (0.3%)
Eden Prairie	56,584 (10%)	17,286 (12%)
Edina	50,417 (9.1%)	13,596 (9.1%)
Golden Valley	29,908 (5.4%)	1,422 (1.0%)
Hanover	109 (<0.1%)	904 (0.6%)
Hopkins	6,306 (1.1%)	4,387 (2.9%)
Independence	2,158 (0.4%)	3,557 (2.4%)
Long Lake	0 (0%)	2,717 (1.8%)
Maple Grove	83,678 (15%)	11,851 (7.9%)
Medina	1,157 (0.2%)	8,090 (5.4%)
Minnetonka	36,452 (6.6%)	20,069 (13%)
Minnetrista	2,877 (0.5%)	8,945 (6.0%)
Other	57,946 (10%)	20,692 (14%)
Plymouth	83,451 (15%)	17,040 (11%)
Shorewood	8,359 (1.5%)	4,561 (3.1%)
Wayzata	666 (0.1%)	5,884 (3.9%)
Homestead Status Change ¹		
0	329,692 (60%)	80,999 (54%)
1	222,374 (40%)	68,345 (46%)
Watershed ¹		

0	70,235 (13%)	15,127 (10%)
1	96,132 (17%)	24,059 (16%)
2	95,257 (17%)	13,203 (8.8%)
3	106,842 (19%)	63,505 (43%)
4	74,309 (13%)	15,754 (11%)
7	76,822 (14%)	5,698 (3.8%)
8	30,374 (5.5%)	11,998 (8.0%)
9	2,095 (0.4%)	0 (0%)
School District ¹		
11	7,625 (1.4%)	119 (<0.1%)
110	121 (<0.1%)	1,614 (1.1%)
111	128 (<0.1%)	961 (0.6%)
270	40,803 (7.4%)	15,474 (10%)
271	113,379 (21%)	7,425 (5.0%)
272	53,607 (9.7%)	17,198 (12%)
273	49,108 (8.9%)	11,176 (7.5%)
276	22,732 (4.1%)	12,934 (8.7%)
277	8,516 (1.5%)	6,985 (4.7%)
278	4,217 (0.8%)	10,335 (6.9%)
279	90,890 (16%)	14,237 (9.5%)
280	1,271 (0.2%)	0 (0%)
281	39,499 (7.2%)	986 (0.7%)
283	32,613 (5.9%)	13,205 (8.8%)
284	63,952 (12%)	30,585 (20%)
728	13,900 (2.5%)	2,222 (1.5%)
877	3,596 (0.7%)	1,498 (1.0%)
879	1,746 (0.3%)	1,540 (1.0%)
883	4,363 (0.8%)	850 (0.6%)
	N = 552,0661	N = 149,3441

¹ Values shown reflect the count of observations and their corresponding percentage of the treatment or control group in parenthesis

Table A10. Summary Statistics (Distance < 2500 Meters)

	Control	Treated
Real Taxes	Mean: \$2,837 SD: \$2,649 Median: \$2,188 Min: \$0 Max: \$94,314	Mean: \$3,129 SD: \$2,973 Median: \$2,362 Min: \$0 Max: \$69,609
Real Market Value	Mean: \$861,832 SD: \$863,288 Median: \$667,178 Min: \$0 Max: \$39,444,707	Mean: \$995,092 SD: \$984,966 Median: \$748,568 Min: \$0 Max: \$29,846,028
City Tax Share	Mean: 0.008 SD: 0.020 Median: 0.003 Min: 0.000 Max: 2.089	Mean: 0.015 SD: 0.035 Median: 0.004 Min: 0.000 Max: 1.147
City/Town ¹		
Bloomington	113,399 (21%)	17,576 (5.3%)
Corcoran	7,989 (1.4%)	1,650 (0.5%)
Dayton	10,610 (1.9%)	1,960 (0.6%)
Eden Prairie	56,584 (10%)	36,478 (11%)
Edina	50,417 (9.1%)	31,479 (9.5%)
Golden Valley	29,908 (5.4%)	11,334 (3.4%)
Hanover	109 (<0.1%)	1,240 (0.4%)
Hopkins	6,306 (1.1%)	8,658 (2.6%)
Independence	2,158 (0.4%)	4,687 (1.4%)
Long Lake	0 (0%)	2,717 (0.8%)
Maple Grove	83,678 (15%)	38,296 (12%)
Medina	1,157 (0.2%)	13,715 (4.2%)
Minnetonka	36,452 (6.6%)	35,156 (11%)
Minnetrista	2,877 (0.5%)	15,740 (4.8%)
Other	57,946 (10%)	49,439 (15%)
Plymouth	83,451 (15%)	44,427 (13%)
Shorewood	8,359 (1.5%)	8,148 (2.5%)
Wayzata	666 (0.1%)	7,325 (2.2%)
Homestead Status Change ¹		
0	329,692 (60%)	175,860 (53%)
1	222,374 (40%)	154,165 (47%)
Watershed ¹		

0	70,235 (13%)	37,310 (11%)
1	96,132 (17%)	54,615 (17%)
2	95,257 (17%)	46,078 (14%)
3	106,842 (19%)	116,371 (35%)
4	74,309 (13%)	34,074 (10%)
7	76,822 (14%)	24,303 (7.4%)
8	30,374 (5.5%)	17,274 (5.2%)
9	2,095 (0.4%)	0 (0%)
School District ¹		
11	7,625 (1.4%)	1,491 (0.5%)
110	121 (<0.1%)	5,213 (1.6%)
111	128 (<0.1%)	1,285 (0.4%)
270	40,803 (7.4%)	38,142 (12%)
271	113,379 (21%)	17,424 (5.3%)
272	53,607 (9.7%)	34,430 (10%)
273	49,108 (8.9%)	24,814 (7.5%)
276	22,732 (4.1%)	20,301 (6.2%)
277	8,516 (1.5%)	11,550 (3.5%)
278	4,217 (0.8%)	16,258 (4.9%)
279	90,890 (16%)	38,593 (12%)
280	1,271 (0.2%)	0 (0%)
281	39,499 (7.2%)	11,205 (3.4%)
283	32,613 (5.9%)	31,357 (9.5%)
284	63,952 (12%)	64,329 (19%)
728	13,900 (2.5%)	5,226 (1.6%)
877	3,596 (0.7%)	3,124 (0.9%)
879	1,746 (0.3%)	2,475 (0.7%)
883	4,363 (0.8%)	2,808 (0.9%)
	N = 552,0661	N = 330,0251

¹ Values shown reflect the count of observations and their corresponding percentage of the treatment or control group in parenthesis

Appendix B

Aggregate ATT Graphs

Figure 6. Aggregate ATTs of Conservation Easements on Real Property Taxes

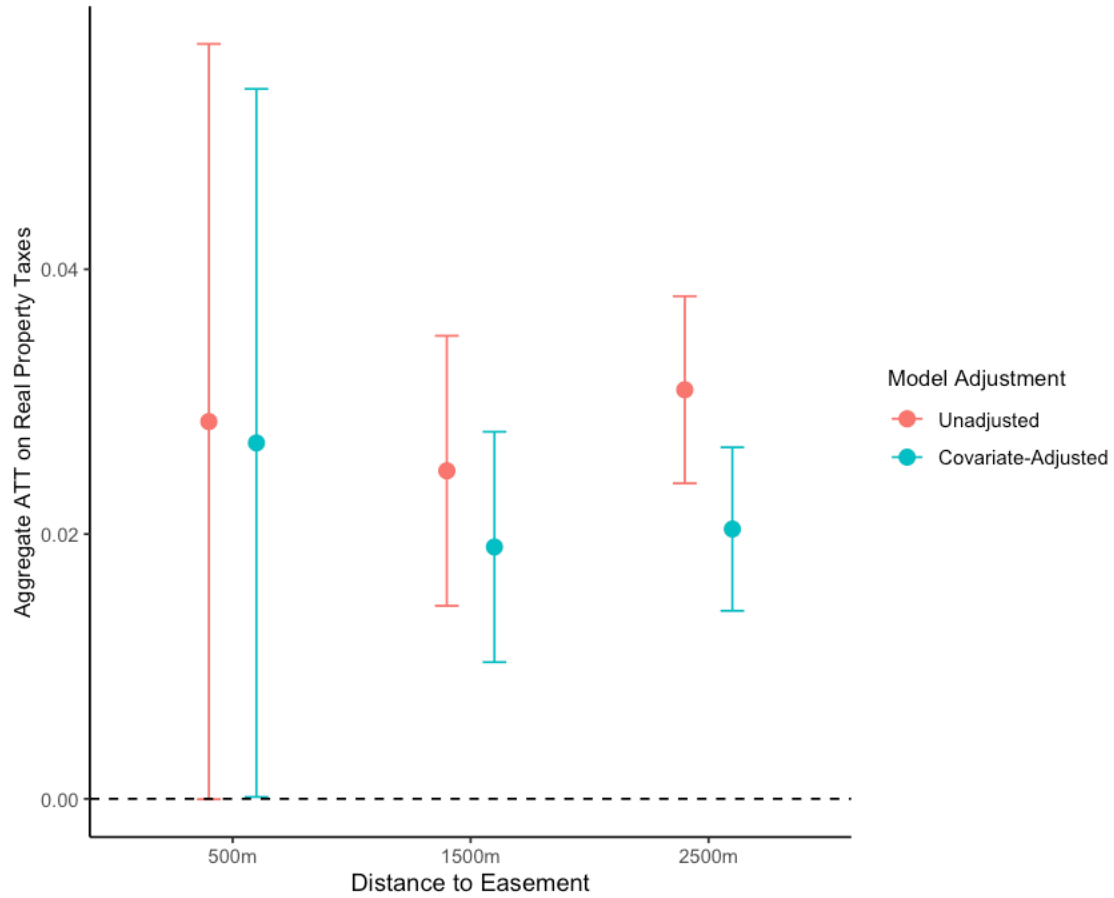


Figure 7. Aggregate ATTs of Conservation Easements on Real Market Value

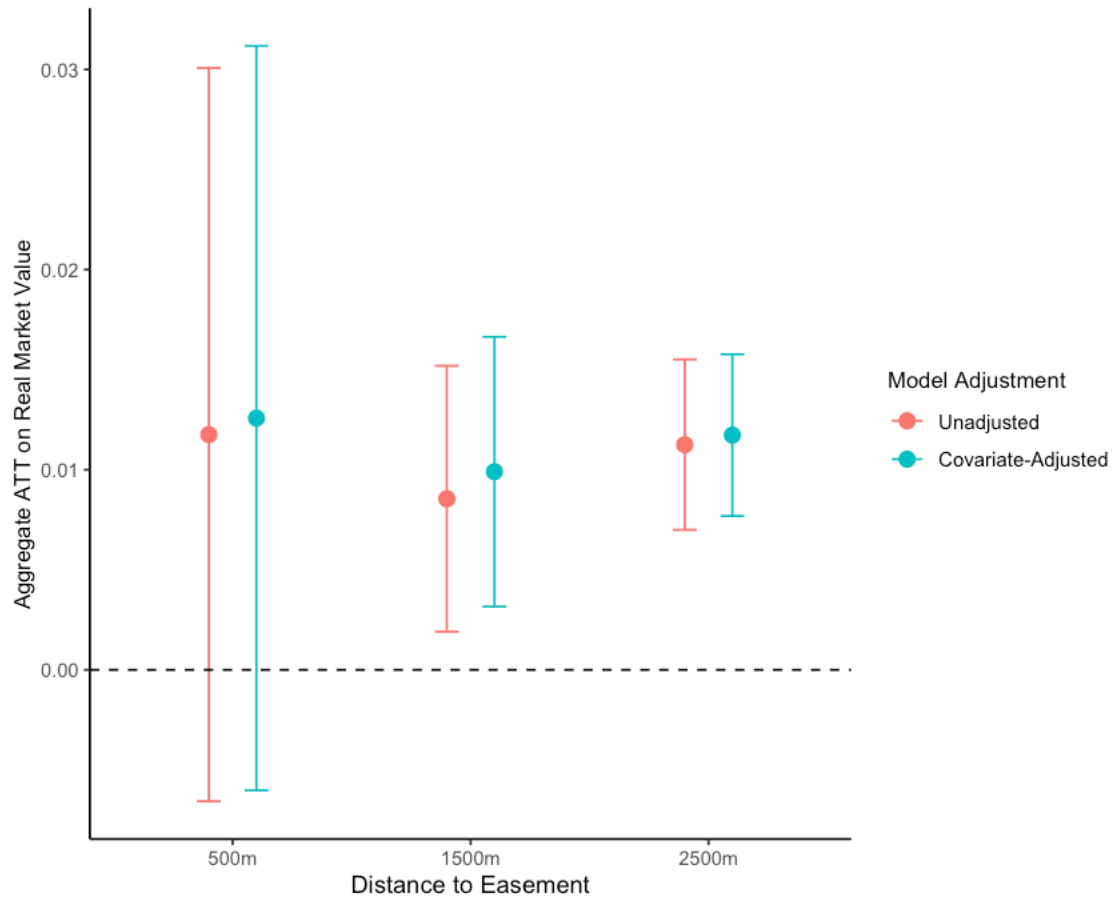
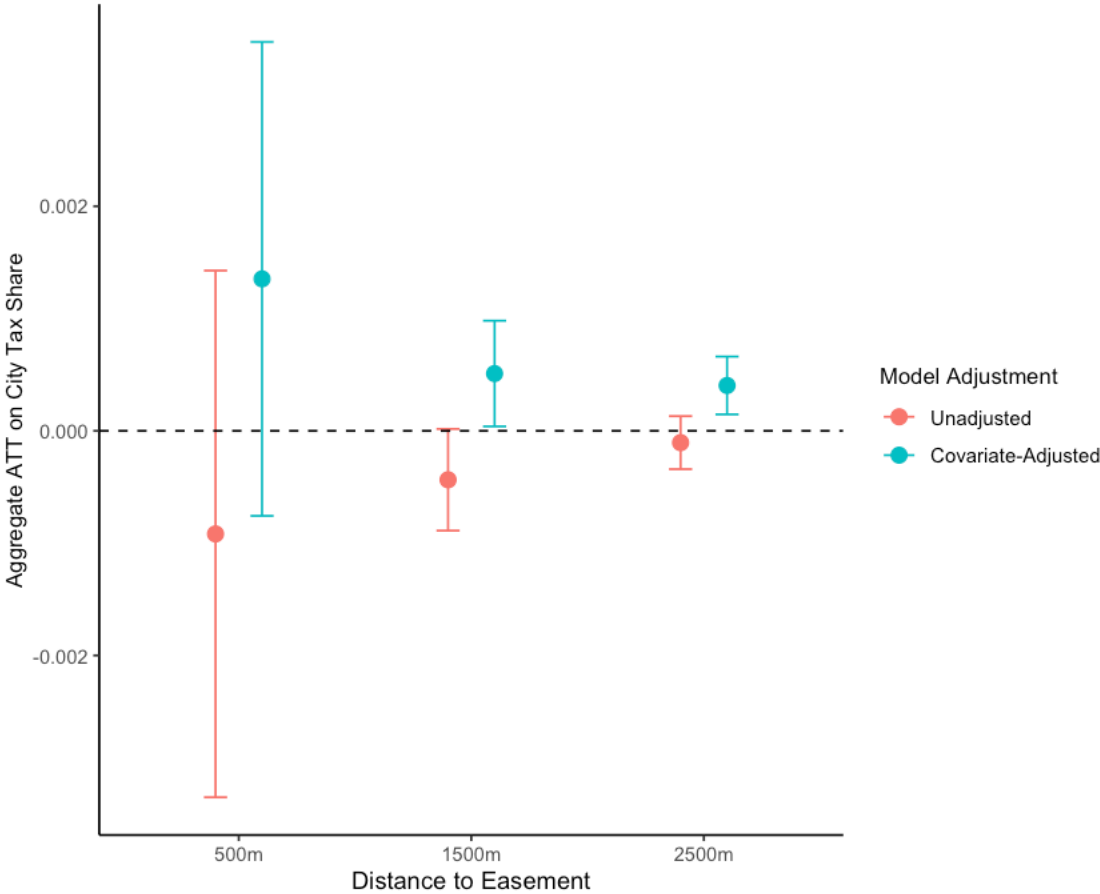


Figure 8. Aggregate ATTs of Conservation Easements on City Tax Share



Event Study Estimates

Table 11. Event Study Estimates on Logged Real Property Taxes

Event Time	500m (No Covs.)	500m (Covs.) ¹	1500m (No Covs.)	1500m (Covs.) ¹	2500m (No Covs.)	2500m (Covs.) ¹
-17	-0.212*	-0.021	-0.122*	0.000	-0.103*	-0.003
-16	-0.042	0.045	-0.045*	0.013	-0.039*	0.004
-15	-0.061*	0.010	-0.034*	-0.001	-0.032*	-0.002
-14	-0.067*	-0.012	-0.030*	-0.003	-0.029*	-0.006*
-13	-0.008	0.017	-0.014*	0.005	-0.011*	0.001
-12	-0.029*	0.001	-0.018*	0.002	-0.013*	0.000
-11	-0.014*	0.002	-0.016*	0.000	-0.014*	-0.001
-10	-0.033	-0.013	-0.014*	-0.001	-0.011*	-0.002
-9	-0.025	-0.011	-0.010*	0.001	-0.009*	0.000
-8	-0.008	0.006*	-0.008*	-0.001	-0.005*	-0.001
-7	-0.004	0.005	-0.005*	0.001	-0.005*	0.000
-6	0.005	0.005	-0.005*	-0.002	-0.004*	-0.002
-5	0.001	0.005	0.000	0.000	0.000	-0.001
-4	-0.003	-0.002	-0.002	-0.003	-0.001	-0.003*
-3	0.002	0.006*	-0.004*	-0.002	-0.002	-0.003*
-2	0.004	0.008	-0.002	-0.001	0.000	-0.001
-1	-0.003	-0.004	-0.003*	-0.004*	0.002	-0.001
0	0.006	0.007	-0.002	-0.002	0.002	-0.001
1	-0.012	-0.012	-0.002	-0.003	0.001	-0.003
2	0.017	0.015	0.024*	0.022*	0.029*	0.023*
3	0.038*	0.035*	0.042*	0.037*	0.044*	0.036*
4	0.019	0.016	0.041*	0.035*	0.047*	0.037*
5	0.027*	0.021	0.038*	0.028*	0.048*	0.034*
6	0.041*	0.031*	0.038*	0.024*	0.048*	0.030*
7	0.056*	0.043*	0.041*	0.025*	0.049*	0.028*
8	0.040*	0.027	0.040*	0.024*	0.050*	0.029*
9	0.047*	0.043*	0.035*	0.022*	0.048*	0.027*
10	0.057*	0.053*	0.030*	0.017*	0.040*	0.021*
11	0.053	0.047	0.024*	0.014	0.036*	0.019*
12	0.045	0.051	0.01	0.013	0.025*	0.017*
13	0.058	0.072	0.009	0.015	0.011	0.009
14	0.040	0.063	0.006	0.011	0.003	0.005
15	0.059	0.088	0.007	0.018	-0.001	0.001
16	0.090	0.143*	0.025	0.044*	0.006	0.010
17	0.116	0.188*	0.014	0.060*	0.019	0.026

¹ Covariate-adjusted models include fixed effects for city, school district, watershed district, and a binary indicator for homestead change

* Statistically significant at the 5% level

Table 12. Event Study Estimates on Logged Market Value

Event Time	500m (No Covs.)	500m (Covs.) ¹	1500m (No Covs.)	1500m (Covs.) ¹	2500m (No Covs.)	2500m (Covs.) ¹
-17	0.012	-0.009	0.007	0.000	-0.001	-0.004
-16	0.052	0.043	0.022*	0.016*	0.009*	0.007
-15	0.015*	0.005	0.008*	0.002	0.003	0.000
-14	0.001	-0.007	0.002	-0.003	0.000	-0.003*
-13	0.028	0.02	0.008*	0.003	0.004*	0.001
-12	0.009*	0.001	0.006*	0.002	0.004*	0.001
-11	0.004	-0.003	0.001	-0.002	0.000	-0.002*
-10	0.003	-0.002	0.001	-0.002	0.000	-0.002*
-9	0.007*	0.004	0.004*	0.002	0.002*	0.000
-8	0.003	0.001	0.001	-0.001	0.000	-0.001*
-7	0.004	0.002	0.000	-0.001	0.000	-0.001
-6	0.006*	0.002	0.000	-0.001	0.000	-0.001
-5	0.006	0.006	0.000	-0.001	0.000	-0.001*
-4	-0.003	-0.004	-0.002*	-0.003*	-0.002*	-0.003*
-3	0.006*	0.007*	-0.001	-0.001	-0.001	-0.001
-2	-0.002	-0.001	-0.002*	-0.002*	-0.002*	-0.002*
-1	-0.004	-0.004	-0.004*	-0.004*	-0.003*	-0.004*
0	-0.001	-0.002	-0.004*	-0.004*	-0.004*	-0.003*
1	-0.010*	-0.010*	-0.009*	-0.008*	-0.007*	-0.007*
2	0.004	0.003	0.011*	0.011*	0.013*	0.013*
3	0.017*	0.017*	0.023*	0.024*	0.025*	0.026*
4	0.016*	0.017*	0.024*	0.026*	0.027*	0.028*
5	0.010	0.012	0.019*	0.020*	0.024*	0.025*
6	0.016	0.017	0.016*	0.017*	0.021*	0.021*
7	0.030*	0.027*	0.017*	0.017*	0.019*	0.018*
8	0.011	0.012	0.011*	0.012*	0.016*	0.016*
9	0.017	0.022	0.008	0.010*	0.014*	0.013*
10	0.020	0.024	0.003	0.004	0.007*	0.007*
11	0.008	0.01	-0.003	0.000	0.002	0.003
12	0.012	0.008	-0.008	-0.004	-0.002	0.001
13	0.011	0.016	-0.008	-0.004	-0.004	-0.001
14	0.024	0.031	-0.006	-0.001	-0.005	-0.001
15	0.052	0.055	0.001	0.004	-0.004	-0.003
16	0.086*	0.110*	0.014	0.025	0.004	0.007
17	0.135*	0.152*	0.035	0.036	0.02	0.013

¹ Covariate-adjusted models include fixed effects for city, school district, watershed district, and a binary indicator for homestead change

* Statistically significant at the 5% level

Table 13. Event Study Estimates on City Tax Share

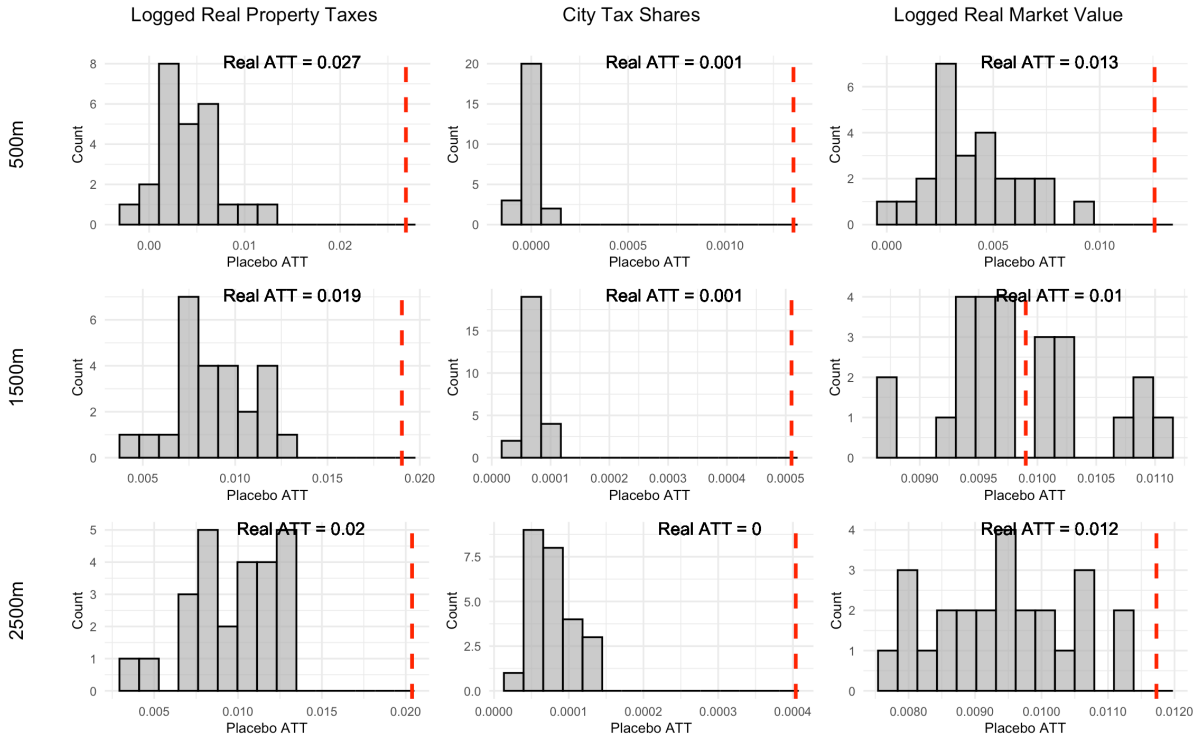
Event Time	500m (No Covs.)	500m (Covs.) ¹	1500m (No Covs.)	1500m (Covs.) ¹	2500m (No Covs.)	2500m (Covs.) ¹
-17	-0.002	0.000	-0.001*	0.000	-0.001*	0.000
-16	0.000	0.001	0.000	0.001	0.000	0.001
-15	0.000	0.000*	-0.000*	0.000	-0.000*	0.000
-14	-0.000*	0.000	-0.000*	0.000	-0.000*	0.000
-13	0.000	0.000	-0.000*	0.000	-0.000*	0.000
-12	-0.001*	0.000	0.000	0.000	0.000	0.000
-11	0.000	0.000	-0.000*	0.000	-0.000*	0.000
-10	-0.000*	0.000	-0.000*	0.000	-0.000*	0.000
-9	0.000	0.000	-0.000*	0.000	-0.000*	0.000
-8	-0.000*	0.000	-0.000*	0.000	-0.000*	0.000
-7	-0.000*	0.000	-0.000*	0.000	-0.000*	0.000
-6	0.000	0.000	-0.000*	0.000	-0.000*	0.000
-5	0.000	0.000	0.000	0.000*	0.000	0.000*
-4	-0.000*	0.000	-0.000*	0.000	-0.000*	0.000
-3	0.000	0.000	-0.000*	0.000	-0.000*	0.000
-2	0.000	0.000	0.000	0.000	-0.000*	0.000
-1	0.000	0.000	-0.000*	0.000	-0.000*	0.000
0	-0.000*	0.000	-0.000*	0.000	-0.000*	0.000
1	-0.001*	0.000	-0.000*	0.000	-0.000*	-0.000*
2	-0.001	0.001	-0.000*	0.000	0.000	0.000*
3	0.000	0.001*	0.000	0.000*	0.000	0.000*
4	-0.001	0.001*	0.000	0.001*	0.000	0.001*
5	-0.001	0.001	-0.000*	0.001*	0.000	0.001*
6	0.000	0.002*	0.000	0.001*	0.000	0.001*
7	0.000	0.003*	0.000	0.001*	0.000	0.001*
8	-0.001	0.002	0.000	0.001*	0.000	0.001*
9	-0.001	0.003	-0.001	0.001*	0.000	0.001*
10	-0.001	0.003	-0.001	0.001*	0.000	0.001*
11	-0.002	0.002	-0.001	0.001*	0.000	0.001*
12	-0.002	0.002	-0.001	0.001	0.000	0.001*
13	-0.003	0.002	-0.001*	0.001	-0.001	0.001*
14	-0.003	0.002	-0.002	0.001	-0.001	0.001
15	-0.005	0.003	-0.002	0.001	-0.001	0.001
16	-0.005	0.006	-0.002	0.002	-0.001	0.001
17	-0.004	0.01	-0.003	0.003	-0.001	0.001

¹ Covariate-adjusted models include fixed effects for city, school district, watershed district, and a binary indicator for homestead change

* Statistically significant at the 5% level

Appendix C

Spatial Placebo Tests



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