Open Space Purchases, House Prices, and the Tax Base

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Abstract: This paper examines the effect of public acquisitions of open space on house prices and the municipal tax base. While a series of studies show that open space acquisitions raise values of nearby properties, no research to date appears to focus upon the effect of open space acquisitions upon local tax base. Existing studies focus on the effect of open space acreage on house prices. We examine the effect of open space expenditures on house prices at the municipal level. We find that a one-dollar increase in open space expenditures per housing unit is associated with average house prices that are about $13 higher and with a tax base that is about $15 lower per acre. Open space expenditures per housing unit also show a consistent positive effect on the percentage change in house prices over the period 1995-2000. However, we find no statistically significant effect from open space expenditures on the percentage change in the tax base over the period 1995-2000. Local funding (rather than state funding) for open space has a smaller impact on house prices but the effect is significant only in some specifications. Despite the negative effect of open space purchases on the tax base, we find that higher open space expenditures are associated with lower tax rates. In addition, we find that while higher tax rates are associated with a lower tax base, a larger tax base does depress tax rates. The percentage change in the general property tax rate over the period 1995-2000 shows a significant negative effect on the percentage change in the tax base per acre over the period.

JEL Codes: H2, H4, Q2
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I. Introduction

Across the U.S., voter interest in land conservation remains high. From 2000 to 2006, U.S. voters considered 1,221 land conservation measures and approved 925 (76%). These measures allocated more than $23.7 billion to land conservation. In 2006, voters considered a total of 128 open space spending measures. About 77% of the measures passed, adding $5.7 billion in new open space spending authority. Owing at least in part to its high population density, New Jersey is among the most actives states in pursuing land conservation. In November of 2006, New Jersey counties and municipalities included 30 measures on the ballot and passed 20 (Trust for Public Land, 2006). As of 2007, 231 New Jersey municipalities (41% of municipalities in the state) and all 21 New Jersey counties collect open space taxes. Annual revenues from the taxes total about $300 million. Not surprisingly, New Jersey has also preserved a substantial amount of land as open space. From May of 1997 to June 2007, more than 450,000 acres of land were preserved as open space in the State of New Jersey.

While the value or willingness to pay for open space has received considerable attention in the literature, economists have generally failed to consider the effect of the acquisitions on the municipal tax base and property taxes. The oversight is surprising. Debates about whether to allow development or to preserve a particular land parcel typically center on the impact development will have on the tax base and/or the tax rate. Preservation advocates assert that open space raises property values and adds to the tax base. With a larger tax base, the municipality may fund current expenditures at a lower tax rate. Preservation opponents typically contend that the acquisitions are too costly and shrink the tax base by reducing the number of economic uses available for a parcel of land or by removing the land from the tax base entirely. Because the tax base is lower, the argument is made that tax rates must rise to compensate.

This paper examines the effect of open space acquisitions on house prices at the municipal level and the municipal tax base in New Jersey. Because New Jersey is highly developed, property values are likely more sensitive to open space acquisitions compared to other US states. We conduct our investigation at the municipal level to capture effects related to financing open space. In New Jersey, open space funding is available at the state, county, and municipal levels. The municipal and county funding is derived from property taxes. Using municipal-level data allows us to capture the effect of property taxes at the level of least aggregation. In New Jersey, both the state (through the Green Acres Program) and municipalities identify parcels for acquisition. The state then considers funding for the acquisition.

Several studies of housing prices outside New Jersey show that the effects of open space are positive for houses in close proximity to the open space but that the effect weakens with distance from the open space. Thus, there could conceivably be benefits to open space for certain homeowners (those that happen to live near the acquired parcel) but costs for other homeowners in the form of higher property taxes (to finance the acquisition).[1] In addition, the benefits to the homeowners proximate to the open space could conceivably be less than the costs to the non-proximate homeowners, leading to a reduction in social welfare in the jurisdiction.

This study also differs from the existing literature on the effects of open space because it measures open space in expenditure terms rather than acreage terms. A given amount of expenditure on open space may buy more land in a low population density area. However, the open space may

[1] Of course, open space acquisitions may restrain growth in municipal budgets by reducing the demand for municipal services.

have less impact on property prices due to the lack of demand pressure. Because property prices vary across locations, measuring expenditures rather than open space acres allows a more direct calculation of the benefits of open space.

For open space expenditures, we find that a $1 increase in spending on open space per housing unit is associated with average house sale prices that are about $13 higher and a tax base per acre that is about $15 lower. Local funding (rather than state funding) for open space has a smaller impact on house prices but the effect is not significant in all specifications. Open space expenditures per housing unit also show a consistent positive effect on the percentage change in house prices over the period 1995-2000. However, we find no statistically significant effect from open space expenditures on the percentage change in the tax base over the period 1995-2000.

Despite the negative effect of open space purchases on the tax base, we find that higher open space expenditures are associated with lower tax rates. However, the reduction in the general property tax rate from increased open space acquisitions is quantitatively small. Using an instrumental variables approach, we find that while higher tax rates are associated with a lower tax base, a larger tax base does depress tax rates. In addition, the percentage change in the general property tax rate over the period 1995-2000 shows a significant negative effect on the percentage change in the tax base per acre over the period. A one percentage point increase in the tax rate reduces the tax base per acre by 1.67 percentage points over the period.

II. Background

House Prices and Open Space

Researchers have examined the value of open space using two basic methods: contingent valuation and hedonic pricing. The contingent valuation studies use survey methods to determine willingness to pay (WTP) for various environmental amenities (e.g., Drake, 1992; Pruckner, 1995; Breffle et al., 1998; Champ and Loomis, 1998; Kline and Wichelns, 1998; Earnhardt, 2001 Earnhardt, 2006). These studies estimate the value of open space adjacent to residential locations by asking survey respondents to state prices for a house with a low level of a specific environmental amenity (e.g., open space). Following these responses, the surveys typically ask respondents to state prices for the same house with a higher level of the same environmental amenity.

In contrast to contingent valuation, hedonic pricing models that evaluate open space use actual markets transactions rather than survey methods (Geoghegan et al., 1997; Bolitzer and Netusil, 2000; Lutzenheiser and Netusil, 2001; Shultz and King, 2001; Irwin, 2002; Geoghegan 2002; Anderson and West, 2006). Hedonic pricing relies on the assumption that the value of environmental amenities will be capitalized into house prices. In essence, a residential property is viewed as a bundle of attributes. Each attribute affects the sales price of the final good. Attributes include measures of house size (e.g., square footage) and the cost of living at the particular location, as well as measures of environmental attributes (e.g., open space near the property).

Much of the literature focuses on determining the relative impact of different types of open space. For instance, open space may differ based on whether the parcel may be developed in the future, the types of uses currently permitted on the open space, the distance between the open space and the housing unit, and the size of the open space parcel. Geoghegan (2002) uses data on real estate transactions from Howard County, Maryland, in a hedonic pricing model and finds that the coefficients for both permanent open space and developable open space are positive and significant. However, the coefficient for permanent open space on property value is three times larger than the coefficient for developable open space (the comparison is against developed land).

Bolitzer and Netusil (2000) and Anderson and West (2006) find that the value of open space generally declines as distance between the open space and the housing unit increases. However, parameter estimates for open space less than 100 feet from the housing unit were generally insignificant. Bolitzer and Netusil state that this is likely the result of congestion effects around public parks. Anderson and West find that increases in property values from proximity to open space are lower further from the central business district. In addition, property value increases due to proximity rise with increases in population density, income, and the fraction of the population under age 18.

Irwin (2002) finds that, using the baseline comparison of some type of developable open space that has a probability of being developed in the future (as opposed to assuming the alternative is developed land), the value of preserving a 10-acre plot of farmland as privately-owned conservation land yields an increase of about $4,500 in the value of neighboring residential property (about 2.6% of the mean residential value). If the government purchases the property outright (the property becomes public land), it increases the value of a neighboring residential property by about $2,000 (about 1.2% of the mean residential value). Irwin attributes the difference to increased automobile traffic and noise that she asserts is typically associated with public lands. Costanza et al. (2006) analyzes the impact of access to beaches and parks on house prices in Central New Jersey. They find that access to the beach (0-300 ft. of distance) has a significant positive effect on house prices. For parks (classified as small, medium, and large on the basis of acreage) the effect was inconsistent across locations in Central New Jersey.

Using the contingent valuation method, Earnhardt (2006) finds that survey respondents in Douglas County, Kansas, place no value on prairie-type open space when the prairie has a 50% chance of development. In contrast, a permanently protected prairie carries a value of about $5,000 (about 5% of total house value). Kline and Wichelns (1998) find that respondents placed higher values on preserved beach and cropland/pasture and lower values on turf farmland, wetlands, and woodlands. Lutzenhiser and Netusil (2001) find that natural area parks have the largest impact on home sales prices followed by golf courses, specialty parks (parks devoted to a single activity such as boating), and urban parks. Likewise, Shultz and King (2001) find that proximity to large protected natural areas, golf courses, percentage of vacant land, and commercial land use, positively affects land values. They also find that the marginal implicit prices for the open space variables are robust to alternative levels of aggregation (blocks, tracts, block groups).

In addition to characteristics of the open space, the literature also considers the relative impact of house and homeowner characteristics on the valuation of open space. Earnhardt (2006) and Breffle et al. (1998) find that the value of open space depends on income level. High-income households are willing to pay more per acre than low-income households. However, other socioeconomic characteristics of the household did not predict willingness to pay for open space. Housing attributes also predict the willingness to pay for open space. Increases in interior space and house age raise the willingness to pay for open space, even after controlling for household socioeconomic characteristics.

Kline and Wichelns (1998) employ a contingent valuation method to measure preferences for preservation of open space in Rhode Island. Respondents born prior to 1945 and respondents with less ecocentric views indicated a lower marginal utility for preserved land.[2] Breffle et al. (1998) also finds that willingness to pay (WTP) for open space decreases at decreasing rate in the distance between the homeowner's property and the open space. WTP for households 0.1 miles from the open space is twice as large as WTP for households 0.4 miles away.

Bates and Santerre (2001) also investigate open space purchases. But rather than estimate the impact of open space (or various characteristics of open space) on house prices, they estimate the amount of open space per capita using data for Connecticut cities and towns. They find that the demand for open space is highly sensitive to changes in income but relatively insensitive to changes in price. Surprisingly, high population growth does not affect the amount of open space per capita but higher municipal populations reduce the amount of open space per capita. Finally, state and federally owned open space and locally owned open space are only weak substitutes.

A number of papers speculate that the higher property values associated with open space may make them self-financing (Bolitzer and Netusil, 2000; Geoghegan, 2002). That is, more open space raises property values and, hence, property tax revenues. Thus, the increased revenues offset the costs of purchasing and maintaining open space. Of course, self-financing of open space is complicated if more open space acquisitions imply higher property taxes and higher property taxes lower house prices. In such a case, house prices close to the open space could conceivably rise while house prices in other sections of the municipality fall. Further, there must be limits to the

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[2] Respondents were asked to select one of three statements to describe their views. Respondents with "ecocentric" views agreed with the statement. "Nature has a right to exist without human intervention regardless of how it benefits or harms humans." Respondents with less ecocentric views agreed with either: 1) "Nature exists only to satisfy the needs of humans, and should be managed for that purpose"; or 2) "Nature should be managed to satisfy the needs of humans, but sometimes should be preserved in its natural state".

amount of open space that can be purchased before property tax revenues decline. If an entire municipality becomes open space, its tax revenue will be zero.

Municipal Tax Rates, the Tax Base, and Open Space

In contrast to the value of open space (or the effect of open space on house prices), the effect of open space on the tax rates and on the tax base has received far less attention. Indeed, only a few studies estimate the determinants of municipal tax rates or the tax base. Brett and Pinske (2000) investigate the determinants of municipal tax rates in British Columbia, and Ladd and Bradbury (1988) investigate the relation between tax rates and the tax base for large U.S. cities. Brett and Pinske argue that tax rates are driven by choices of local government. These government choices are in turn explained by the tax base as well as desires of voters in the municipality. But tax rates also reflect competition among jurisdictions because neighboring jurisdictions may divert capital from the municipality by offering more favorable tax rates.

As a consequence, a series of theoretical models use game theory to analyze tax rates across jurisdictions (Wildasin, 1988; Hoyt, 1991). To capture this interdependence, Brett and Pinske model the municipal tax rate as a function of local characteristics and a weighted average of tax rates in neighboring jurisdiction. However, they find no evidence of competition over tax base.

In addition, there is a simultaneous relation between property tax rates and the property tax base. Higher property tax rates may reduce the size of the base but a larger tax base may allow municipalities to meet their budgetary requirements with lower tax rates. Consequently, Brett and Pinske estimate a simultaneous equation model for tax rates and the tax base.[3] They model the tax base as a function of municipality characteristics, the local tax rate plus the tax rate at other governmental levels (i.e., the regional district), tax rates in adjoining municipalities, and characteristics in adjoining municipalities. They model the tax rate as a function of municipality characteristics, the tax rate at other levels of government, and the tax base. The percentage of seniors is included in the tax equation as a proxy for the demand for public services.

Ladd and Bradbury (1988) also model the simultaneous relation between the tax rate and the tax base for large U.S. cities. Rather than a focus on possible interdependence among municipalities, Ladd and Bradbury examine the impact of local property taxes on the city's tax base. They point out that higher property taxes may lower the tax base because the higher tax rates are capitalized into lower property values or the higher tax rates lower the level of business and residential activity. Thus, the relation between tax rates and the tax base is endogenous.

Ladd and Bradbury model the market value of the per capita property tax base in a city as a function of the property tax revenues per capita and add controls for other types of taxes, the level of city services, and demographics. The property tax revenue equation is built around the balanced budget requirement. It, therefore, incorporates the determinants of total revenue requirements (i.e., per capita income of city residents, service-specific cost indices, the property tax base per capita, and a measure of city government service responsibilities) as well as determinants of the revenue mix (i.e., exogenous intergovernmental aid, availability of non-property tax sources).

[3] Lang and Jian (2004) also consider the relation between property taxes and the tax base. However, their study considers the state of Massachusetts where a law limits the rate of property tax increases. Consequently, the law limits the endogeneity between property taxes and the tax base.

III. Data and Methods

House Prices and Open Space

Following Lutzenhiser and Netusil (2001), Schultz and King (2001) and Irwin (2002) we specify the hedonic residential pricing model as:

(1) $P_i = f(S_i, N_i, K_i)$

where S_i is a vector of housing characteristics for municipality i, N_i is a vector of neighborhood - locational characteristics for municipality i, and K_i is a vector of land use variables for municipality *i*. The dependent variable (P_i) is mean house sale price by municipality for the State of New Jersey in the year 2000 (or the percentage change in the mean house sale price over the period 1995-2000). Theoretical models of hedonic pricing do not specify a particular empirical model or restrictions to the functional form. However, Cropper et al. (1988) argues that linear specifications are the best method to estimate hedonic price functions. They simulated outcomes using consumers with known utility functions and found that when some house attributes are unobserved, linear, log-log linear, and linear Box-Cox specifications performed best. We report only the linear and log-log linear specifications here. The more general Box-Cox specification yielded similar results with regard to the sign and statistical significance variable pertaining to open-space purchases. We do not report the Box-Cox results because the linear and the log-log linear specifications are more readily interpreted from an economic perspective.

The data on single-family home sale prices were gathered from the New Jersey Department of the Treasury. Total open space expenditures and state open space expenditures are compiled from files at the New Jersey Department of Environmental Protection (NJDEP). As of 2000, open space acquisitions totaled more than 62,000 acres at a total cost of more than a billion dollars (in year 2000 dollars).[4] The State of New Jersey financed about 38% of these costs.

NJDEP also supplied data on travel distance to NY City. Municipality population, median rooms per housing unit, median family income, seasonal housing units, and the proportion of housing units built before 1960 are from the U.S. Census Bureau. Land use/land cover data is a composite of 1995/97 land use/land cover analysis developed by NJDEP and updated for 2000 using information developed by Richard Lathrop at The Center for Remote Sensing and Spatial Analysis at Rutgers University using satellite images.

The Tax Base, Tax Rates, and Open Space

Like house prices, the tax base (land and improvements) is a function of housing characteristics, neighborhood/locational characteristics, and land use variables. In addition, the tax base is also a function of the tax rate. However, the tax base and the tax rate are determined simultaneously (Brett and Pinske, 2000; Ladd and Bradbury, 1988). That is, higher property tax rates may reduce the size of the base because higher tax rates deter development and the higher tax rates are capitalized into the tax base. However, a larger tax base may allow municipalities to meet their budgetary requirements with lower tax rates. Thus, we need an instrument to identify the tax rate. We use the ratio of assessed value of property to the true value of property for this purpose. As he ratio falls, tax rates should rise. Consequently, we estimate the following:

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[4] New Jersey also supports a farmland preservation program that acquires development rights for agricultural land. We do not have data for these acquisitions and therefore all farmland (both preserved and unrestricted) is included in our undeveloped land variable described below. Similarly, any land or development rights acquired solely by private land preservation groups are included only in the undeveloped land category and not in the open space expenditures variable.

(2) $R_i = g\ (N_i, K_i, A_i)$

(3) $B_i = h\ (N_i, K_i, \hat{R}_i)$

where A_i is the ratio of the assessed value of property to the true value of property for municipality i (or the difference in the assessed to true ratio between 1995 and 2000), B_i is the tax base per acre of land for municipality i (or the percentage change in the tax base over the period 1995-2000). R_i is the general tax rate per $100 of property value (or the percentage change in the tax rate over the period 1995-2000), and $\hat{R}_i$ is the fitted value for R_i. Data on tax bases, tax rates, years since the most recent reassessment or revaluation, and the ratios of assessed property values to true values are from the New Jersey Department of Community Affairs. We do not include housing characteristics in the specification because high value land may contain a large number of smaller housing units or a small number of large (and expensive) housing units.

IV. Results

House Prices and Open Space

Table 1 reports means and standard deviations for the dependent (House Price, Tax Base) and the independent variables. Chart 1 shows that in general the highest house prices are concentrated in the corridors that runs from New York City to Princeton and along the New Jersey Shore. Variation in average house prices across the state was substantial; the lowest price municipality was just under $40,000 per unit (City of Camden, Camden County) and the highest price municipality was over $1 million (Alpine Borough, Bergen County). There are six municipalities (of 566) that reported no house sale data for the year 2000.[5] Because bigger houses on larger lots should (all else constant) raise house prices, we expect that house prices will increase with average residential parcel size per housing unit (Average Parcel) and the median number of rooms per housing unit (Rooms).

For the open space variables, we expect that higher expenditures on open space per housing unit (Open Space Exp) will raise house prices. More open space translates into greater amenities, and the value of the amenities is capitalized into the house price. We gauge these open space purchases in monetary rather than acreage terms because the value of an acre of land (or an acre of open space) differs across locations. That is, an acre of land should be more valuable where residential property values are higher. Because the dependent variable is house price, we construct the open space spending measure on a per-housing-unit basis.

The statewide mean open space expenditures are $451 per housing unit. However, there is quite a bit of variation across municipalities, and about half of New Jersey municipalities have no open space expenditures. From Table 1 we see that the average cost share (a simple unweighted average across municipalities) for the State on open space purchases is about 40%. We expect that greater state support in making open space purchases will raise house prices because a larger fraction of the total cost will not need to be financed through local property taxes. Viewed alternatively, a smaller state share for a given open space acquisition means higher property taxes, and higher property taxes should cause lower house prices.

The remaining variables (Pre-1960, NYC dist, Seasonal, and Undeveloped) capture various aspects of the desirability of the location of the municipality. Because of the labor market opportunities and the amenities offered by New York City, we expect that greater distance from

[5] The missing municipalities are: Audubon Park Borough; Pine Valley Borough; Tavistock, Borough; Teterboro Borough; Walpack Township; and Winfield Township.

New York City (NYC dist) will lower house prices.[6] Likewise, recreational opportunities associated with easy access to Atlantic beaches will raise house prices. We capture this effect with the percentage of total housing units that are seasonal (Seasonal).

We expect that higher percentages of housing units constructed before 1960 will be associated with higher house prices because many of the older municipalities are clustered near New Jersey cities, Philadelphia, and New York City. Likewise, larger percentages of undeveloped land (Undeveloped) will reflect lower demand for land, lower land prices, and therefore, lower house prices. In constructing the Undeveloped variable, we exclude any land acquired as open space. Less desirable locations will also be associated with less intensive land use.

Table 2 reports correlation coefficients for the independent variables. From the table, we can see that open space expenditures are not highly correlated with either the housing or the location variables. One problem variable is average residential parcel size (Average Parcel). Average parcel size is highly correlated with both undeveloped land and the median number of rooms (r = 0.66 and 0.56, respectively). To correct for this problem, we regress average parcel size on undeveloped land and use the residual to control for parcel size in subsequent analyses. This allows us to interpret the parcel size coefficient as the effect of parcel size after controlling for the scarcity of land in the municipality.

Table 3 reports regressions on average house price by municipality. Column 2 of Table 3 reports the regression on house sale price for the entire data set, column 3 adds average parcel size (residual) as an independent variable, column 4 reports the regression for municipalities that had at least one parcel acquired as open space (during the period 1961-2000), and column 5 reports

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estimates for the log-log transformation.[7] The log-log transform causes the loss of 22 additional observations (compared with column 3) because these municipalities had either no seasonal housing, or no undeveloped land.[8] Despite this, the estimates are quite consistent across specifications. All estimates are corrected for heteroskedasticity using the Huber/White/sandwich estimator of variance.

Open space expenditures per housing unit show a consistent, positive, and significant effect on house prices across all specifications. A one-dollar increase in open space expenditures per housing unit is associated with average house prices that are about \$13 higher. Adding average parcel size as a control reduces the estimated coefficient for open space expenditures by about \$2. From column 5 in Table 3, we see that a one-percent increase in open space expenditures per housing unit is associated with house prices that are 0.05 percent greater. The ratio of state open space spending to total open space spending has a positive effect on house prices but is significant only in the log-log specification at the 10% level (using a two-tailed test). This suggests some evidence in favor of the hypothesis that the source of the funding is an important determinant of the effect of open space on house prices. If the financing is derived mainly from property taxes, then the effect of the higher property taxes may reduce the effect of the open space on house prices.

Both the size of the average residential parcel and the median number of rooms by municipality have a significant positive effect on house prices. A one-room increase in the median number of rooms raises the average house price by about \$80,000. Because rooms are correlated

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[6] Distance to Philadelphia was highly correlated with distance to New York, so we only employ distance to New York in the subsequent analysis.

[7] Examination of the residuals from both the linear and log-log linear estimates shows a somewhat better fit for the log-log specification. We find the same result for the tax base estimates reported below.

[8] If we run the log-log specification with non-transformed versions of seasonal housing and undeveloped land to avoid losing these observations, the results are similar. The estimate for open space expenditures is about the same ($\beta = 0.062$, $p < 0.01$) but the average State cost share of open space acquisitions is no longer statistically significant.

with parcel size, the introduction of parcel size depresses the estimate for rooms by about $15,000. A similar effect occurs for parcel size if we remove rooms from the regression. Increases in the distance from New York City are associated with lower average house prices. House prices are on average about $1,900 lower for each one-mile increase in the distance from New York City. Compared to Detached and NYC dist, the percentage of undeveloped land has a smaller impact. The percentage of developed land does not have a consistent effect on house prices across specifications and is significant (and negative) only in the log-log specification. In addition, the estimates for the effect of open space expenditures are not sensitive to excluding the undeveloped land variable from the model.

Both Seasonal and Pre-1960 show significant positive effects on average house price. A one percentage-point increase in the percentage of seasonal housing units is associated with an average house price that is about $4,000 higher. While the percentage of total housing units constructed prior to 1960 (pre-1960) is statistically significant in both the full sample and the sample that includes only municipalities with open space purchases, the parameter estimate is statistically insignificant in the log-log specification.

Changes in House Prices and Open Space

To test whether spending on open space correlates with changes in house prices, we calculate the percentage change in house prices for each New Jersey municipality for the period 1995 to 2000. During this period, the average percentage increase in house prices was 19.43 (a simple unweighted average across municipalities) for the State (see Table 1). Three municipalities had appreciation of over 100% for the period (Alpine Borough, Bergen County; Port Republic City, Atlantic County; and Far Hills Borough, Somerset County). There are four municipalities that reported no house sale data for 1995.[9] Because of data limitations we are not able to calculate percentage changes for the independent variables. Consequently, all of the independent variables in are the same as in Table 3 above.

We expect that higher levels of spending on open space per housing unit will be associated with greater percentage increases in house prices. As noted above, more open space translates into greater amenities, and the value of the amenities is capitalized into the house price. In addition, we expect that greater state support in making open space purchases will cause an increase in house prices because a larger fraction of the total cost will not need to be financed through local property taxes.

Table 4 reports the results of regressions with percentage change in house price for the period 1995-2000 as the dependent variable. Column 2 of Table 4 reports the regression on percentage change in house sale price for the entire data set, column 3 adds average parcel size (residual) as an independent variable, column 4 reports the regression for municipalities that had at least one parcel acquired as open space (during the period 1961-2000), and column 5 reports estimates for the log-log transformation. The dependent variable in column 5 is the log ratio of the average house price in 2000 to the average house price in 1995. Once again, all estimates are corrected for heteroskedasticity using the Huber/White/sandwich estimator of variance.

Open space expenditures per housing unit show a consistent positive effect on the percentage change in house prices across all specifications. However, the estimates are significant only in the first three specifications. In the log-log specification, the estimated effect of the log of

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[9] The missing municipalities are: Millstone Borough; Rockleigh Borough; Stockton Borough; and Wrightstown Borough. Because we are missing six observations for 2000, we lose a total of ten observations on the percentage change in house price variable.

open space expenditures cannot be statistically bounded from zero. In general, a one-dollar increase in open space expenditures per housing unit is associated with an increase in house prices of 0.007 percent. Using the mean value of open space expenditures per housing unit of $451, this implies that the average house price in the state rises rose an additional 3 percentage points during the 1995-2000 time period because of the open space acquisitions. However, the effect of open space expenditures per housing unit on the percentage change in house prices estimate is sensitive to outliers. If we delete the three municipalities that had more than 100% increases in house prices over the period, the estimated effect decreases from 0.007 to 0.0013. Despite this, the estimate is still significant at the 0.05 level.

The ratio of state open space spending to total open space spending has a positive effect on the percentage change in house prices but is significant only in the log-log specification at the 10% level (using a two-tailed test). This suggests some evidence in favor of the hypothesis that the source of the funding is an important determinant of the effect of open space on house prices. If the financing is derived mainly from property taxes, then the effect of the higher property taxes may reduce the effect of the open space on house prices.

Municipalities that were closer to New York City, had a higher median number of rooms, a higher percentage of units built before 1960, and a higher percentage of units that were seasonal units showed larger increases in average house prices over the period. A one-room increase in the median number of rooms is associated with a 4 percentage point increase in average house prices over the period. Decreases in the distance from New York City are associated with larger percentage increases in average house prices. House prices showed an additional 0.12% increase over the period for each one-mile decrease in the distance from New York City. House prices showed an additional 0.6% increase over the period for a one percentage-point increase in the percentage of seasonal housing units. House prices showed an additional 0.07% increase over the period for a one percentage-point increase in the percentage of housing units built prior to 1960.

The Tax Base, Tax Rates, and Open Space

The average tax base per acre (a simple unweighted average across New Jersey municipalities) is $294,797 (see Table 1). We construct the tax base measure on a per-acre basis because of the possibility that lower taxable acreage due to open space acquisitions might reduce the tax base. Chart 2 shows that in general the highest tax bases per acre are clustered near New York City, Philadelphia, and along the New Jersey Shore. Variation in tax bases per acre across the state was substantial; the lowest tax bases per acre were $175 and $700 (Walpack Township, Sussex County and Washington Township, Burlington County) and the highest tax bases per acre were $2,324,394 and $2,984,022 (Hoboken City, Hudson County and Guttenberg Town, Hudson County).[10]

From a theoretical perspective, the effect of higher open space spending on the tax base per acre of land is indeterminate. On the one hand, higher open space expenditures are associated with higher house prices (see above). With higher house prices, the tax base is also higher. On the other hand, the acquisitions remove land from the tax rolls and lower the tax base. To investigate the net relationship, we estimate regressions on the tax base per acre for New Jersey municipalities. Table 5

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[10] Walpack Township is a special case. The Tocks Island dam (now deauthorized) was slated for construction in an area that includes Walpack Township. The expectation that the land would be inundated caused property owners to sell out. Including Walpack Township has no impact on the results. We omit one municipality of 566 from the analysis (Winfield Township, Union County) because its tax rate is more than four times as high as the next highest tax rate. Inclusion of Winfield Township in the analysis does not affect the basic results but it does affect effect some estimates in the equations that do not correct for endogeneity.

reports these regressions for the entire sample of New Jersey municipalities. Column 2 reports a regression on the tax base per acre that treats the tax rate as an exogenous variable. Column 4 reports an instrumental variables regression that treats the tax rate as an endogenous variable. Column 3 reports the regression on tax rate with the ratio of assessed to true value of land and improvements as the instrument.

Table 6 reports estimates for regressions on the tax base per acre and the general property tax rate for municipalities with open space acquisitions. We report only the log-log transformation for the restricted sample because non-transformed estimates for the restricted sample look much like the Table 5 results. As in Table 5, column 2 of Table 6 reports a regression that treats the tax rate as an exogenous variable. Column 4 reports an instrumental variables regression that treats the tax rate as an endogenous variable. Column 3 reports the regression on tax rate.

The general property tax rate shows a significant negative effect on the tax base per acre across all specifications. From column 2 of Table 5, we see that an additional $1 per $100 of assessed value is associated with a tax base per acre that is about $25,500 lower.[11] Because the tax rate may be endogenous (a higher tax base may cause lower property tax rates), we instrument for the tax rate using the ratio of assessed to true values.[12] The true burden of the property tax is the tax payment in relation to the value of the asset. Ceteris paribus, homeowners in general should be indifferent between a $300,000 house assessed at full value with a tax rate of $2 per $100 of

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[11] A one dollar increase in the tax rate represents about a 33% increase on average.

[12] In addition to this two-stage least squares (2SLS) approach, we also performed the analysis using three-stage least squares (3SLS). This approach estimates the three equations (house price, tax base, tax rate) simultaneously, rather than separately as in 2SLS. Statistically speaking the 3SLS approach yields parameter estimates that are more efficient than those from the 2SLS approach. This is because, unlike 2SLS, 3SLS ensures that the error terms are not correlated with the parameters in the equations. For the present study, estimates from 3SLS are across the board quite similar to those obtained via 2SLS. This implies that the error terms in the three different equations of our 3SLS specification are uncorrelated. We report the results of the simpler specification—2SLS —here by virtue of the principle of Ockham's razor.

assessed value and a $300,000 house assessed at half its market value with a tax rate of $4 per $100. Thus, a higher assessed-to-true-value ratio should be associated with lower property tax rates.

To ensure that the instrument is valid, we test whether the instrument (assessed-to-true value) is uncorrelated with the error term in the final tax base equation (Column 4). First, we estimate the tax base equation (with the fitted values for the tax rate) and obtain the residuals. Then, we regress the residuals on all exogenous variables (including the instrument and a constant). The results show that for the instrument the *t*-statistic in the residuals regression is insignificant. We repeat this process for the log-log specification reported in Table 5 and derive the same result. Thus, the instrument is uncorrelated with the errors in the main equation (tax base per acre). Column 3 of Tables 4 and 5 shows a strong effect of Assessed to True Value on the tax rate (t = 18.3 and t = 20.2, respectively); a one percentage point increase in the assessed-to-true value reduces the tax rate by about $0.11 per $100 of assessed value.

Column 4 of Table 5 reports the instrumental variables estimates using the fitted value for the tax rate. Comparing the estimates for the tax rate in columns 2 and 4, we see that the effect of the tax rate on the tax base is different after correcting for endogeneity. In the uncorrected equation reported in column 2, an increase in the tax rate of $1 per $100 of assessed value is associated with a tax base per acre that is about $25,500 lower. The corrected estimate in column 4 shows that an increase in the tax rate of $1 per $100 of assessed value is associated with a tax base per acre that is about $35,000 lower. In both equations, higher tax rates are associated with a lower tax base. The corrected estimate thus shows an impact that is $9,500 greater because it removes the effect of the tax base on the tax rate. This suggests that a larger tax base does depress tax rates. Estimates of the effect of the tax rate for the subsample in the log-log transformation reported in Table 6 show a similar effect. In percentage terms, a one percent increase in the tax rate is associated with a tax base that is 1.1 percent lower (see the corrected equation in column 4 of Table 6).

Open space expenditures per housing unit yield a negative effect on the tax base per acre across all specifications. In the full sample, a one dollar increase in open space spending per housing unit lowers is associated with a tax base per acre that is about $15 lower. In the subsample with log-transformed variables, a one-percent increase in open space expenditures per housing unit is associated with a tax base that is about 0.1 percent lower. If we estimate the effect of open space expenditures on the tax base for the subsample without transforming the variables (not reported), we find a significant negative effect with a somewhat lower parameter estimate ($\beta = -12.15$, $p < 0.01$ versus $\beta = -15.45$, $p < 0.01$). Despite the fact that we find a negative effect of open space expenditures on the tax base, column 3 in Tables 5 and 6 shows that higher levels of open space expenditures are associated with lower tax rates.

Although the focus of the paper is the tax base, we ran additional specifications of the tax rate equation that included a series of additional variables designed to capture the demand for municipal services.[13] We employed an instrumental variables approach and used a fitted value for the tax base. Based on results from Tables 5 and 6, we used the undeveloped land variable as an instrument for the tax base. The estimates of the effect of open space expenditures on the tax rate were consistently significant and robust to inclusion of these additional variables. However, the negative effect on the tax rate from increases in open space expenditures is relatively small ($\beta = -0.0001$, $p < 0.01$). That is, the tax rate per $100 of valuation would fall by about $0.045 if open space expenditures per household rise from zero to their mean value ($\bar{x} = 451$). This suggests that

[13] We included poverty rates, the ratio of total commercial land values to total residential land values, percentage of the population that is of school age, total population, and population density.

although open space acquisitions shrink the tax base, their effect in reducing the demand for services outweighs their effect in reducing the revenue yield from a given tax rate.

Year Assessed records the last year that a municipality was reassessed or revalued. It is intended as a check for the process through which the municipalities update the values of land and improvements based in part on rules set by the State of New Jersey. A large positive estimate for Year Assessed would suggest that that process by which the state estimates the tax base in New Jersey fails to adequately capture changes in the value of land and structures. Estimates of Year Assessed in Table 3 show positive values that are small relative to the tax base per acre (0.5%). Moreover, the effect is not significant in only one specification (column 2 of Table 6).

Among the remaining variables, NYC dist and Undeveloped yield significant negative effects on the tax base per acre. Seasonal shows the expected significant and positive effect on the tax base. Parameter estimates for these variables are essentially the same regardless of whether the regressions are run on the full sample or the subsample that includes only those municipalities with an open space acquisition. As noted above, each of these variables captures some aspect of the desirability of a particular location. Labor market opportunities and the amenities offered by New York City, cause higher land values and more intensive use of land. Thus, a one-mile increase in the distance between a municipality and New York City is associated with the tax base per acre that is on average about $3,500 lower. The estimates for the transformed variables show that a municipality that is one percent further from New York City tends to have a tax base per acre that is 0.7% less. By contrast, municipalities with recreational opportunities associated with easy access to Atlantic beaches (Seasonal) have higher tax bases per acre. If the share of total housing units that are seasonal is one percentage-point higher, the tax base per acre is on average about $6,500 greater.

Larger percentages of undeveloped land (Undeveloped) reflect lower demand for land and a lower intensity in land use. A share of undeveloped land that is one percentage point higher is associated with a tax base per acre that is about $6,400 less.

Changes in the Tax Base, Tax Rates, and Open Space

To test whether spending on open space correlates with changes in the tax base per acre, we calculate the percentage change in the tax base per acre for each New Jersey municipality for the period 1995 to 2000. During this period, the average percentage increase in the tax base per acre was 20.84 (a simple unweighted average across municipalities) for the State (see Table 1). Fourteen municipalities had increases in the per-acre tax base of more that 150% for the period.

As noted above, we were not able to obtain measures for many of the dependent variables for 1995 (i.e., Rooms, Pre-1960, Seasonal, and Undeveloped). However, we did obtain municipal tax rates and the ratio of assessed to true values for 1995. From Table 1 we see that the average property tax rate increased about 10% over the period and the ratio of assessed to true values fell slightly (about 1.7 percentage points). We use differences in assessed to true values rather than percentage changes because the ratios in each individual year are already expressed as percentages. Table 7 reports these regressions for the entire sample of New Jersey municipalities. Column 2 reports a regression on the percentage change in the tax base per acre that treats the percentage change in the tax rate as an exogenous variable. Column 4 reports an instrumental variables regression that treats the percentage change in the tax rate as an endogenous variable. Column 3 reports the regression on the percentage change in the tax rate with the difference in the ratio of assessed to true value of land and improvements as the instrument. We suppress the R^2 value in column 4 because it is negative.[14]

Table 8 reports estimates for regressions on the log ratio of the tax base by municipality in 2000 to the tax base by municipality in 1995 and the log ratio of the tax rate by municipality in 2000 to the tax rate by municipality in 1995 for municipalities with open space acquisitions. We report only the log-log transformation for the restricted sample because non-transformed estimates for the restricted sample look much like the Table 8 results. As in Table 7, column 2 of Table 8 reports a regression that treats the tax rate as an exogenous variable. Column 4 reports an instrumental variables regression that treats the percentage change in the tax rate as an endogenous variable. Column 3 reports the regression on the percentage change in the tax rate. For the estimates in Tables 7 and 8 we test for the validity of the instrument using the procedure outlined above and find similar results.

The percentage change in the general property tax rate over the period 1995-2000 shows a significant negative effect on the percentage change in the tax base per acre over the period across all specifications. Comparing the estimates for the percentage change in the tax rate in columns 2 and 4, we see that the effect of the tax rate on the tax base is different after correcting for endogeneity. In the uncorrected equation reported in column 2, we see that a one percent increase in the tax rate reduces the tax base per acre by 0.57 percentage points. The corrected estimate in column 4 shows that we see that a one percent increase in the tax rate reduces the tax base per acre

[14] The R^2 is negative because the model sum of squares (MSS) is negative. MSS is negative because the error sum of squares (ESS) exceeds the total sum of squares (TSS). This may occur with instrumental variables because some independent variables enter the model as fitted values when the parameters are estimated and the model's residuals are computed using independent variables different than those used to fit the model. Thus, the ESS is no longer constrained to smaller than the TSS.

by .80 percentage points. The corrected estimate shows an impact that is 0.023 percentage points higher because it removes the effect of the tax base on the tax rate.

As in the estimates for the tax base levels reported in Tables 5 and 6, this suggests that a larger tax base does depress tax rates. Estimates of the effect of the tax rate for the subsample in the log-log transformation reported in Table 8 show a similar effect. The estimates of the effect of changes in the tax rate to changes in the tax base are somewhat sensitive to outliers. If we remove from the analysis all municipalities that showed an increase of 150% or more for the period (14 municipalities), the parameter estimate for the effect of tax rate changes drops from 1.67 to 1.22.

Despite the strong effect that open space expenditure levels had on tax base levels (see Tables 5 and 6), open space expenditures show no significant effects on the percentage change in the tax base per acre. However, we find a significant negative effect of open space expenditures on changes in tax rates in the semi-log specification (see column 3 of Table 8). This is consistent with the effect of open space expenditures on the tax rate levels reported in Tables 5 and 6. Among the remaining variables, Undeveloped is associated with increases in the tax base. A one-percentage point increase in the percentage of land that is undeveloped is associated with a 0.4 percentage point increase in the tax base over the period. Not surprisingly then municipalities with relatively large amounts of undeveloped land show a lower tax base per acre but also greater percentage increases in that tax base. Higher levels of seasonal housing units and houses built prior to1960 were associated with decreases in the percentage change in the tax base over the period.

V. Conclusion

Open space programs are generally popular with voters, and a relatively large literature in economics suggests why: proximity to open space raises house prices. But questions about open space programs remain. The literature shows that the effects of open space purchases are highest for houses nearest open space. But while open space purchases may raise house prices for houses near the open space, they could conceivably do so at the expense of other houses in the jurisdiction that are further away, by means of higher property taxes. If higher property taxes reduce house prices, as some researchers have suggested, then open space purchases could conceivably cause the municipality's average house price to fall. In addition, open space purchases could conceivably reduce the tax base, forcing a rise in the tax rate as the municipality must finance its public services from a smaller tax base. We investigate concerns that open space purchases harm average homeowners by reducing the available tax base and forcing a rise in property tax rates.

We find that although open space purchases reduce the tax base, they are not associated with higher tax rates. Further, we find that open space purchases are associated with higher house prices. Higher property tax rates are associated with a lower tax base; we also find evidence that larger tax bases reduce the property tax rate. Controlling for the effect of the tax base on the tax rate, we find that an increase in the property tax rate of $1 per $100 of valuation is associated with a tax base per acre that is about $35,000 lower. In addition, the percentage change in the general property tax rate over the period 1995-2000 shows a significant negative effect on the percentage change in the tax base per acre over the period.

We gauge the effect of differences in open space *expenditures* rather than open space *acres* on house prices. Because the value of an acre of land can vary radically with location, this metric allows a more direct assessment of the net fiscal benefits of open space purchases at the municipal level. A one-dollar increase in open space expenditures per housing unit is associated with average house prices that are about $13 higher and with a tax base per acre that is about $15 lower. Using the mean value of open space expenditures per housing unit of $451, this implies that the average house in the state is worth an additional $5,800 because of the open space acquisitions and the average tax base per acre is about $6,700 lower because of the open space acquisitions. In addition, open space expenditures per housing unit also show a consistent positive effect on the percentage change in house prices over the period 1995-2000. However, we find no statistically significant effect from open space expenditures on the percentage change in the tax base over the period 1995-2000.

Local funding (rather than state funding) for open space has a smaller impact on house prices, but the effect is statistically significant only in the log-log specification. Despite the negative effect of open space purchases on the tax base, we find that open space expenditures are associated with lower tax rates. However, the reduction in the general property tax rate associated with higher open space acquisitions is small. This suggests that the effect of open space in reducing demand for local services is somewhat larger than its effect in reducing the tax base.

Because open space acquisitions are associated with a lower tax base per acre, the acquisitions likely divert development activity or eliminate it altogether. Future studies should attempt to evaluate the manner in which the activity is diverted. That is, we need to determine the extent to which the acquisitions cause development of other greenfields in less desirable locations (or out of state), redevelopment of brownfields, more intensive use of already developed lands, and more efficient use of existing space.

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Table 1. Descriptive Statistics for the Study's Variable Set

Variable	N	Mean	Standard Deviation
House Price	560	210,786	139,732
Average # of Rooms	566	6.09	1.02
Average Parcel Size	566	0.448	0.414
% Pre-1960 Housing	566	49	21.1
% Seasonal Housing	566	4.51	12.84
Distance to NYC	566	48.05	31
% Land Undeveloped	566	28.5	23.4
Open Space	566	451.86	2244.7
State's Share of Open Space $s	316	0.401	0.141
Tax Base	566	294,797	340,620
Tax Rate	565	3.22	2.5
Year Assessed	566	1990.4	8.39
Assessed/True	566	85.6	16.4
%Δ House Price	556	19.43	20.26
%Δ Tax Base	565	20.84	64.31
%Δ Tax Rate	566	10.70	30.88
Δ Assessed/True	566	-1.73	16.35

Notes:
House Price$_i$ = average price per housing unit in dollars for municipality i in 2000.
Average # of Rooms$_i$ = median number of rooms per housing unit for municipality i in 2000.
Average Parcel Size$_i$ = average residential lot size in acres for municipality i in 2000.
% Pre-1960 Housing$_i$ = percentage of total housing units that were built prior to 1960 for municipality i in 2000.
% Seasonal Housing$_i$ = percentage of total housing units that are seasonal units for municipality i in 2000.
Distance to NYC$_i$ = distance (in miles) between the municipality and New York City.
% Land Undeveloped$_i$ = Undeveloped land (less acreage acquired as open space) as a percentage of total acreage as of 2000 for municipality i.
Open Space Expenditures$_i$ = total real open space expenditures (in 2000 dollars) as of 2000 per housing unit for municipality i.
State's Share of Open Space \$s$_i$ = the ratio of real state-financed open space spending to real total open space spending for municipality i.
Tax Base$_i$ = total tax base (land and improvements) in dollars per acre for municipality i in 2000.
Tax Rate$_i$ = nonequalized general property tax rate per $100 of assessed value for municipality i in 2000.
Year Assessed$_i$ = year of latest assessment (or revaluation) of property values (as of 2000) for municipality i.
Assessed/True$_i$ = ratio of total market value to assessed value expressed as a percentage for municipality i in 2000.
%Δ House Price$_i$ = percentage change in average price per housing unit by municipality for 1995-2000.
%Δ Tax Base$_i$ = percentage change in the total tax base per acre by municipality for 1995-2000.
%Δ Tax Rate$_i$ = percentage change in general property tax rate per $100 of assessed value by municipality for 1995-2000.
Δ Assessed/True$_i$ = ratio of total market value to assessed value expressed as a percentage for municipality i in 2000 less ratio of total market value to assessed value expressed as a percentage for municipality i in 1995.

Table 2. Correlation Coefficients for Independent Variable Set

	Open Space $s	Ave # of Rooms	% Pre-1960	Distance from NYC	% Seasonal Housing	Average Parcel Size	% Undeveloped Land	State Share of Open Space $s	Year Assessed
Open Space $s	1								
Average # of Rooms	0.1990	1							
% Pre-1960 Housing	-0.0627	-0.2020	1						
Distance to NYC	-0.0878	-0.0435	-0.2264	1					
% Seasonal Housing	-0.0358	-0.0716	-0.0856	0.3196	1				
Average Parcel Size	0.1948	0.5651	-0.3315	0.1714	0.043	1			
% Land Undeveloped	0.0055	0.2561	-0.4363	0.2834	-0.1401	0.6669	1		
State Share of Open Space $s	-0.0896	-0.0194	0.1241	-0.0098	-0.0166	-0.0343	-0.082	1	
Year Assess	0.0253	-0.0112	-0.0207	0.1536	0.0231	-0.0082	0.0383	0.0422	1
Tax Rate	-0.0630	-0.2217	0.2027	-0.2180	-0.1418	-0.1733	-0.1735	0.0078	-0.3502

Table 3. Determinants of Average House Price in 2000 by Municipality in New Jersey

Dependent Variable:	House Price	House Price	House Price	ln(House Price)
Constant	-228,450***	-130,723***	-157,478***	9.86***
	(32,582)	(34,448)	(52,680)	(0.264)
Open Space $s	15.82***	13.43***	13.75***	0.055***
	(4.73)	(4.78)	(5.02)	(0.015)
State Share of Open Space $s			20,603	0.053*
			(29,064)	(0.031)
Average Parcel Size+		97,683***	100,371***	
		(30,776)	(40,747)	
Average # of Rooms	81,461***	64,883***	63,293***	2.02***
	(5,511)	(5,214)	(7,949)	(0.128)
% of Pre-1960 Housing	311.2*	317.7**	628.6***	0.028
	(179.2)	(173.1)	(243.7)	(0.032)
Distance to NYC	-1,936***	-1,991***	-1,967***	-0.413***
	(113.1)	(112.2)	(174.7)	(0.029)
% of Seasonal Housing	3,933***	3,930***	3,975***	0.111***
	(313.7)	(325.1)	(487.8)	(0.015)
% of Land Undeveloped	-169.2	91.03	505.1	-0.060***
	(203.1)	(218.6)	(382.9)	(0.022)
R^2	0.67	0.69	0.69	0.75
N	560	560	312	290

Standard errors in parentheses.
* = significant at the .1 level, ** = significant at the .05 level, *** = significant at the .01 level.
+ = residual

Table 4. Determinants of Percentage Change in Average House Price between 1995 and 2000 across New Jersey Municipalities

Dependent Variable:	% Δ House Price	% Δ House Price	% Δ House Price	ln (house price $_t$ ÷ house price $_{t-1}$)
Constant	-12.65**	-5.35	-15.79**	-0.328
	(6.02)	(6.99)	(8.23)	(0.351)
Average House Price 2000	-0.000014	-0.000024	0.000011	0.0168
	(0.00002)	(0.00002)	(0.00002)	(0.035)
Open Space $s	0.0072***	0.0068**	0.0075***	0.0016
	(0.0029)	(0.0030)	(0.003)	(0.0085)
State Share of Open Space $s			7.02	0.018*
			(5.69)	(0.010)
Average Parcel Size+		8.70	0.122	
		(6.39)	(5.10)	
Average # of Rooms	4.31***	4.30***	3.99***	0.286***
	(0.844)	(1.12)	(1.49)	(0.074)
% of Pre-1960 Housing	0.073*	0.073*	0.083*	0.0071
	(0.043)	(0.044)	(0.050)	(0.012)
Distance to NYC	-0.140***	-0.161***	-0.134***	-0.051***
	(0.027)	(0.028)	(0.039)	(0.019)
% of Seasonal Housing	0.615***	0.639***	0.670***	0.040***
	(0.084)	(0.083)	(0.113)	(0.006)
% of Land Undeveloped	0.0340	0.0544	0.050	-0.0091
	(0.046)	(0.045)	(0.067)	(0.0092)
R^2	0.32	0.33	0.47	0.33
N	556	556	312	292

Standard errors in parentheses.
* = significant at the .1 level, ** = significant at the .05 level, *** = significant at the .01 level.
+= residual

Table 5. Determinants of Tax Base per Acre in 2000 by Municipality in New Jersey

	2SLS Model		
Dependent Variable:	Tax Base	Tax Rate	Tax Base
Constant	-3,703,118*	33.32	-1,836,758
	(2,204,219)	(20.27)	(2,479,112)
Tax Rate+	-25,490***		-34,896***
	(4,661)		(7,378)
Assessed/True Value		-0.106***	
		(0.0058)	
Open Space $s	-14.76***	-0.00010***	-15.45***
	(4.26)	(0.000038)	(4.37)
Year Assessed	2,173*	-0.011	1,250
	(1,118)	(0.0102)	(1,254)
% of Pre-1960 Housing	1,607***	0.012***	1,741**
	(581.5)	(0.004)	(604.4)
Distance to NYC	-3,745***	0.011***	-3,536***
	(519.1)	(0.0029)	(521.9)
% of Seasonal Housing	6,670***	-0.0355***	6,487***
	(2,138)	(0.0057)	(2,037)
% of Land Undeveloped	-6,350***	0.0050	-6,452***
	(682.1)	(0.0038)	(648.5)
R^2	0.48	0.49	0.48
N	565	565	565

Standard errors in parentheses.
* = significant at the .1 level, ** = significant at the .05 level, *** = significant at the .01 level.
+= fitted value in column 3

Table 6. Determinants of ln(Tax Base) per Acre in 2000 by Municipality in New Jersey

		2SLS Model	
Dependent Variable:	ln(Tax Base)	ln(Tax Rate)	ln(Tax Base)
Constant	-81.58	-16.17	-20.91
	(88.95)	(25.90)	(95.84)
ln(Tax Rate)[+]	-0.852***		-1.11***
	(0.141)		(0.186)
ln(Assessed/True Value)		-1.01***	
		(0.050)	
ln(Open Space Expenditures)	-0.083**	-0.067***	-0.101***
	(0.035)	(0.0094)	(0.036)
ln(Year Assessed)	13.06	2.87	5.13
	(11.71)	(3.42)	(12.60)
ln(% of Pre-1960 Housing)	0.097	0.0355	0.111
	(0.077)	(0.026)	(0.080)
ln(Distance to NYC)	-0.672***	0.031	-0.702***
	(0.071)	(0.023)	(0.073)
ln(% of Seasonal Housing)	-0.103***	-0.073***	-0.120***
	(0.037)	(0.010)	(0.039)
ln(% of Land Undeveloped)	-0.792***	0.0046	-0.798***
	(0.054)	(0.015)	(0.055)
R^2	0.70	0.74	0.70
N	300	300	300

Standard errors in parentheses.
* = significant at the .1 level, ** = significant at the .05 level, *** = significant at the .01 level.
[+]= fitted value in column 3

Table 7. Determinants of the Percentage Change in Tax Base per Acre from 1995 to 2000 by Municipality

			2SLS Model	
Dependent Variable:	% ΔTax Base	% ΔTax Rate	1995 Tax Rate	% ΔTax Base
Constant	-1,659.0***	505.52*	27.84*	-165.7***
	(551.97)	(296.12)	(16.37)	(551.97)
1995 Tax Base per Acre	-0.0000069	-0.000014***	-0.00000021	-0.000010
	(0.00001)	(0.000005)	(0.0000002)	(0.000013)
1995 Tax Rate$^+$	2.940***			0.822
	(1.108)			(2.731)
% ΔTax Rate$^+$	-0.598***			-1.599***
	(0.097)			(0.298)
1995 Assessed/True Value		-0.156*	-0.0922***	
		(0.087)	(0.005)	
Change in Assessed/True Value		-0.946***	-0.0280***	
		(0.104)	(0.006)	
Open Space $s	0.000139	-0.00022	-0.00010***	0.000282
	(0.00041)	(0.00056)	(0.000031)	(0.00061)
Year Assessed	0.840***	-0.252*	-0.0086*	0.103
	(0.280)	(0.150)	(0.0083)	(0.369)
% of Pre-1960 Housing	-0.213**	0.0401	0.0401	-0.213**
	(0.099)	(0.059)	(0.059)	(0.099)
Distance to NYC	0.169	-0.00813	-0.0051**	0.0904
	(0.163)	(0.046)	(0.0025)	(0.186)
% of Seasonal Housing	-0.303*	-0.276***	-0.0124***	-0.408*
	(0.161)	(0.090)	(0.005)	(0.211)
% of Land Undeveloped	0.364*	-0.0205	-0.0079***	0.348
	(0.203)	(0.061)	(0. 0034)	(0.234)
R^2	0.70	0.30	0.58	na
N	300	564	564	564

Standard errors in parentheses.
* = significant at the .1 level, ** = significant at the .05 level, *** = significant at the .01 level.
$^+$ = fitted value in column 4

Table 8. Determinants of the Percentage Change in ln(Tax Base per Acre) from 1995 to 2000 by Municipality

		2SLS Model		
Dependent Variable:	ln (Tax Base $_t$ ÷ Tax Base $_{t-1}$)	ln (Tax Rate $_t$ ÷ Tax Rate $_{t-1}$)	ln(Tax Base $_t$)	ln (Tax Base $_t$ ÷ Tax Base $_{t-1}$)
Constant	-55.37***	40.95*	51.29*	-33.99
	(20.03)	(22.11)	(28.17)	(27.19)
Tax Base per Acre in 1995	-0.0936**	-0.00637	-0.0176	-0.0787**
	(0.038)	(0.016)	(0.020)	(0.0389)
1995 Tax Rate+	-0.108***			-0.0688*
	(0.037)			(0.42)
% ΔTax Rate+	-0.640***			-0.831***
	(0.11)			(0.088)
Assessed/True Value in 1995		0.0938**	-1.090***	
		(0.047)	(0.060)	
Change in Assessed/True Value		-0.861***	-0.0984	
		(0.061)	(0.078)	
Open Space $s	-0.0161	-0.0132	-0.0554***	-0.0160
	(0.0126)	(0.0080)	(0.010)	(0.013)
Year Assessed	7.542***	-5.387*	-7.530**	4.708
	(2.64)	(2.92)	(3.72)	(3.58)
% of Pre-1960 Housing	-0.0422	-0.0628***	0.100***	-0.0651*
	(0.032)	(0.021)	(0.028)	(0.037)
Distance to NYC	0.0479**	-0.0159	0.0270	-0.0480**
	(0.021)	(0.023)	(0.029)	(0.022)
% of Seasonal Housing	-0.0245***	-0.0193**	-0.0524***	-0.0173*
	(0.009)	(0.088)	(0.011)	(0.010)
% of Land Undeveloped	0.0345	0.0111	-0.0272	0.0220
	(0.0216)	(0.019)	(0.024)	(0.023)
R^2	0.48	0.61	0.75	0.43
N	299	299	299	299

Standard errors in parentheses.
* = significant at the .1 level, ** = significant at the .05 level, *** = significant at the .01 level.
+ = fitted value in column 4

Chart1. Average Residential Sale Prices

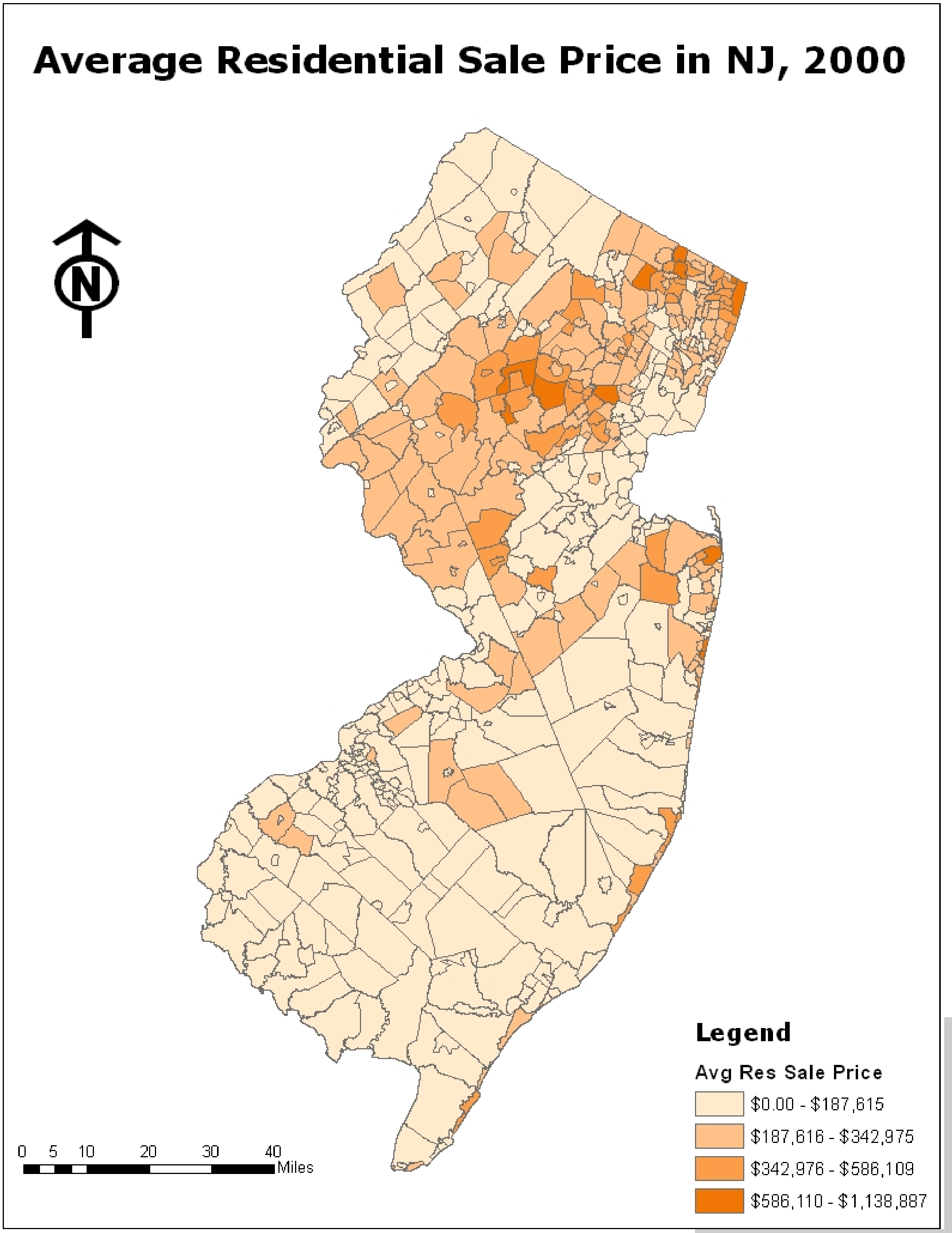

Chart 2. Tax Base per Acre