Current Use Property Taxation In the Conservation of New Hampshire Land: An Empirical Investigation Using Multiple Imputations

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Lincoln Institute of Land Policy
Working Paper

Lincoln Institute Product Code: WP12DU1

Abstract

Urban fringe lands used for nonmetropolitan purposes face higher property taxes if they are assessed at fair market value. Therefore the owners of such land (agricultural, forest) are often inclined to sell all or portions of their properties to cover rising tax bills. In order to delay tax induced land conversion, most of the states are using current use (CU) value of land for tax purposes.

The objectives of this essay are to identify the factors that affect the participation and withdrawal of CU designated land from the CU program in New Hampshire. Our findings suggest that increases in land value, property tax rates, close proximity to Manchester and higher property tax savings result in increase in enrollment in the program. Also, the results suggest a lower withdrawal of land from the program in towns with higher property tax savings and higher average land value.

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Current Use Property Taxation In the Conservation of New Hampshire Land: An Empirical Investigation Using Multiple Imputations

Introduction

Conversion of agricultural and forest land or other open space land for residential and commercial development have been of great concern over the past few decades. Conservation of open space land not only delays haphazard development, but also promises benefits such as regional food supply and environmental pollution control. For many people, natural resources are an important part of their lives. Therefore, preservation of natural areas generally benefits the economic well-being of current and future residents. However, the development pressures created by economic development result in an appreciation of land value. Although this value increment is beneficial for the landowner, it may not be helpful for their ability to pay increasing property taxes. Property taxes based on the market value of open space in the urban fringe areas are more likely to be higher than the land's current potential income (Malme, 1993). A reduction in property taxes may offer an economic incentive for the owners to retain the lands in their current use. Therefore, some sort of a preferential taxation program has been adopted in most of the states (Stienbarger, 2004).

The current use (CU) property taxation program is one of the preferential taxation systems adopted in the U.S. to slow down the pace of tax-induced development. The CU program focuses on the land's income potential, rather than on the fluctuating real estate market value of undeveloped land, in property tax calculations. Lands that qualify for the CU program include undeveloped farm land, forest land, certified tree farms, wet lands and other sites unsuitable for agriculture. CU programs became a trend in states in the 1970s even through some states had previously adopted similar programs before 1970. Such programs have been widely accepted across the country over the past two decades. A property taxation system based on the current use of undeveloped land is necessary to provide a shield against higher property taxes. Therefore, the CU taxation program makes ownership of lands less burdensome for the urban fringe landowners.

Current use preferential assessment is mainly implemented as three approaches. Basically, most states have built-in safety methods to recapture the loss of property tax revenue in the case of withdrawal of lands from the CU program. The three variant approaches are pure preferential assessment, deferred assessment with rollback penalties and preferential assessment with sale value penalties (England & Mohr, 2003; Kashian, 2004). In pure preferential assessment, there is no penalty imposed for withdrawing lands from the CU program. The states that adopt a pure preferential assessment are mostly rural, where speculative advantages are minimal. Preferential assessments with penalties are mostly intended to recapture the loss of property tax revenue, as well as to avoid speculative advantages by having the land in the program.

In New Hampshire, "Yes to 7," or later known as the Statewide Program of Action to Conserve our Environment (SPACE), campaigned to allow land to be taxed at current use value. In 1973, the New Hampshire General Court enacted RSA 79-A. This law allows land to be taxed according to the current use value rather than the real estate market value. Since the initiation of the CU act in New Hampshire, nearly 3 million acres have been enrolled in the CU program. According to the CU reports, about 50 percent of land are enrolled in the New Hampshire CU program (see table 1). Figure 1 shows the trend in CU land enrolled over the period 1999-2008. In New Hampshire, an owner who wishes to include a land in the CU program needs to apply separately. Hence, the enrollment in the program is voluntary. In New Hampshire, a land typically has to be at least 10 acres to qualify. However, smaller parcels may also qualify if the income earned exceeds $2,500 in the four of last five years. CU lands are assessed according to the income earning potential of the land. Table 2 shows the assessment value per acre of different land categories. Accordingly, farmland assessment in New Hampshire ranges from $25-425 per acre, whereas unproductive and wetlands are assessed at $15 per acre. On average, per acre tax savings is about $339 (see table 3). However, if a landowner decides to sell or develop an enrolled land for any metropolitan use, a withdrawal penalty is imposed. In New Hampshire, the withdrawal penalty equals to a 10 percent sales value of the land.

The initiation of current use valuation programs has led to many studies on the subject, which range from theoretical models to empirical studies. Most empirical studies on CU program generally agree that such programs provide a substantial tax relief to participating landowners (Brockett et al.,2003; Morris, 1998; Polyakov & Zhang, 2008). Contrary to the benefits gained from the CU program, this is often criticized. The most cited criticism regards the opportunity gained by land speculators. According to Malme (1993), the penalty charged for the withdrawal from the CU program is not significant for major developers. The requirement of minimum acreage, use of land for the said use for the last five years and binding contracts help to divert such speculators. Another criticism is the revenue loss for towns. This concern leads to another critique: Does this imply a tax shift to homeowner and business properties? However, the above concerns on the shift of tax burden or the loss of revenue are counterbalanced by the requirement of fewer public services for undeveloped land areas compared to residential areas and most of the commercial lands (American Farmland Trust, 2004). Some studies show evidence that casts doubt upon the success of the program (Parks & Quimio,1996; William et al., 2004). The reasons for ineffective outcomes in CU program are non-agricultural considerations that over powered the incentives provided by the CU program and less stricter CU withdrawal penalties (Brockett et al., 2003).

Although there is a considerable amount of literature on CU programs, empirical studies that verify theoretical predictions are limited. The models developed by (Anderson & Griffing, 2000; Capozza & Helsley., 1989; England & Mohr, 2003) identified several testable inferences that need empirical verifications. We did not find such empirical studies, especially for New Hampshire. Therefore, this study focuses on verifying the effect of the following factors in protecting New Hampshire land from urban development. The objectives of this paper are to test the influences of change in population, the distance to Boston, average land value (ALV), full value tax rate (FVTR) and property tax savings on total acres of land enrolled in the CU program for the period 1999-2008.

This paper is organized as follows. First, the theoretical models and hypotheses are summarized. Then we discuss the multiple imputations technique we used to treat missing data. The next section describes data, methodology and our model specifications. The third section presents results obtained using panel data analysis. The paper concludes with a summary of key findings and a discussion on possible suggestions for further research on CU programs.

Conceptual Models Used for the Analysis and Hypotheses

This section summarizes the theoretical models used to base the inferences about CU programs that are considered in the paper. The models are related to the effect of Central Business Districts (CBD), property tax rates, land use change tax and population growth on land values. The models considered are by Anderson & Griffing (2000); Capozza & Helsley (1989) and England & Mohr (2003).

Distance to Central Business Districts:

According Anderson (1986) and Cappoza & Helsley (1989), the value of a land is determined by four distinct components. The first component is the value of accessibility, which depends on the transportation cost, the mean lot size and the distance to the CBD. Close proximity to the CBD and the easiness of accessibility increase land value (see figure 3). It is assumed that a decline in economical and developmental influence begins from CBD at a distance of Z*. The second component is the conversion value. The presence of the conversion value corresponds to a considerable value hike for lands at the urban fringe compared to rural areas. Therefore, land prices rise at a distance of Z* from CBD. The third component is the value of future rent increase. This expected rent increase depends on the distance to the CBD. It is assumed that the expected future rent increases are higher at the urban fringe. The fourth component of land value is the current use value, which does not depend on the distance to the CBD. When we take these four components into consideration, it is clear that land prices are declining with increase in distance to the CBD. Therefore, the land parcels at the urban fringe face higher real estate market values, as well as higher property taxes. This signals that the landowners at the urban fringe are more inclined to enroll in the CU program. Therefore, our first hypothesis is that enrollment in the CU program is higher when the land is located close to the business district. In this paper, two cities considered as influential business districts are Boston, MA and Manchester, NH.

Therefore, following land value models proposed in the literature, we hypothesize that $\frac{\delta\, Propotion\, of\ CU\ Land}{\delta\, Distance\, to\, CBD} < 0$ and $\frac{\delta\, Propotion\, of\ CU\ Land\ Removed}{\delta\, Distance\, to\, CBD} < 0$.

Full Value Tax Rate, Land Use Change Tax (LUCT) and Population Growth:

The theoretical model developed by England & Mohr (2003) on current use taxation derives some important testable implications. Their inter-temporal model of land development includes features specific to the CU program. According to the model, a landowner decides the timing of development (*D*), considering the pecuniary benefits before/after the development (*c* and *u*) and non-pecuniary benefits (*n*) only before the development. Therefore, the owner chooses a time to develop the land when the present value of her income stream is maximized. The model is:

$$\underbrace{\int_{t=0}^{t=D}[c(t)+n(t)-\tau A(t)]e^{-rt}dt}_{\substack{Present\ value\ of\ returns\\ to\, undeveloped\\ land,\, net\ of\ taxes}} - \underbrace{P(D)e^{-rD}}_{\substack{Present\ value\\ of\ penalty\\ on\, withdrawal}} + \underbrace{\int_{t=D}^{t=\infty}[u(t)-\tau A(t)]e^{-rt}dt}_{\substack{Present\ value\ of\\ returns\, to\, developed\\ land,\, net\ of\ taxes}}$$

In the above, τ is the property tax rate, *r* is the owner's discount rate, *P* is the penalty fee and *t* denotes time. Following England & Mohr (2003) model predictions, we hypothesize an increase in land enrollment for the program with higher property tax rates (τ). We use the term full value tax rate (FVTR) to denote the τ of England and Mohr model. That is, $\frac{\delta\, Propotion\, of\ CU\ Land}{\delta\, FVTR} > 0$ and $\frac{\delta\, CU\ withdrawal}{\delta\, FVTR} < 0$. Following above model predictions, we hypothesize that $\frac{\delta\, Propotion\, of\ CU\ Land}{\delta\, ALV} > 0$ and $\frac{\delta\, CU\ withdrawal}{\delta\, ALV} < 0$.

In this paper, we consider the Land Use Change Tax (LUCT)[1] at town level over time. That is, withdrawal of land from the CU program results in a penalty for the owners, which is measured as LUCT per acre of CU land removed. When LUCT is higher, short-term enrollment may be costly for the owner. Therefore, with higher LUCT, landowners may be reluctant to withdraw land from the program. Therefore, with higher LUCT, the

[1] LUCT -A tax that is levied when the land use changes from open space use to a non-qualifying use-Department of Revenue Administration, New Hampshire.

given proportion of land enrolled in the program is likely to be higher. Therefore, we hypothesize $\frac{\delta \, Propotion\, of\; CU\; Land}{\delta \, LUCT} > 0$ and $\frac{\delta \, CU\; withdrawal}{\delta \, LUCT} < 0$.

Also, we test the effect of population growth (*g*). We assume if there is a higher growth rate in population, then there is a decline in the acres of land enrolled in CU program to accommodate the increased population. There are three possibilities when we consider the effect of change in population on land allocation. First, a new population may get settled in a land that is already developed. Second, the new population may get settled in an undeveloped land that is enrolled in the CU program or, third, in a land that is not enrolled in the program (see figure 4). Therefore, the changes in land enrollment in the CU program for changes in population may be hard to capture with simple population statistics. However, this interest led us to develop our hypothesis, that an increase in population results a decline in land enrolled in the CU program and higher withdrawal from the program: $\frac{\delta \, Propotion\, of\; CU\; Land}{\delta \, Population} < 0$ and $\frac{\delta \, CU\; withdrawal}{\delta \, Population} > 0$.

Also we hypothesize higher tax savings received from the program lead to higher enrollment and lower withdrawal of land from the program. Hence, $\frac{\delta \, Propotion\, of\; CU\; Land}{\delta \, Tax\; savings} > 0$ and $\frac{\delta \, CU\; withdrawal}{\delta \, Tax\; savings} < 0$. Our hypotheses are summarized in table 4.

Missing Data Treatment -Multiple Imputation Method

Many techniques have been developed in the past as a solution for the issue of missing data (Carter, 2006). However, researchers often use ad-hoc approaches (Honaker & King, 2010; Wayman, 2003) in handling missing data, which may ultimately do more harm than good. The methods used can be of simple listwise deletion, pairwise deletion, mean substitution, simple hot deck and missing data imputation methods. Listwise deletion or complete case analysis is the deletion of observations that have missing values on one or more of the variables in the data set. This means that the researcher removes all the records that have missing data on any variable. Listwise deletion is the default in most statistical software, but it may lead to significant sample size reduction available for the analysis. In pairwise deletion, a researcher uses all possible observations in estimating individual summary statistics, using the resultant estimates to compute the regression estimates. This method is considered as a better method compared to listwise deletion. In some cases, the missing observations are replaced by an average of the variable, known as mean imputation or mean substitution. Although this is considered to be a mean preserving method, it affects the marginal distribution of data. All the above methods do not eliminate the possibility of biased results (Phillips & Chen, 2011). In simple hot deck imputations, missing values are replaced by a randomly drawn value - a bootstrap procedure (Cameron & Trivedi, 2005). Although this method preserves the marginal distribution of the variable, it affects the covariance and correlations between variables. To overcome the limitations in all the above methods, in 1987 Rubin proposed a multiple imputations scheme. It has been widely used over the past by the researchers in many study areas. In contrast to single imputation, the multiple imputations (MI) method (Rubin, 1996) replaces each missing value with a set of credible values to represent the uncertainty about the right value to impute. MI has several desirable features. Such features include its usability in any kind of analysis without specialized software, its yield of unbiased estimates, and the possibility of obtaining good estimates for standard errors etc. The literature with formal recommendations on number of imputations is very minimal. It is often cited that 3 to 10 multiple imputations are enough to obtain valid inferences (Kammerer, 2009; Royston et al., 2009; Rubin, 1996). According to recent literature more imputations are recommended to reduce sampling error due to imputations.

Studies that have used multiple imputations to treat the missing data problem are to be found in various academic literatures from statistics, economics, political science etc. Norman (2009) examines the `resource curse' using data on historic resource stocks. According to Norman (2009), the empirical work in this area has suffered from data limitations; data on past natural resource bases and use is patchy and often unreliable, especially in historically poor and less developed countries. Norman (2009) replaces missing data using the MI technique to minimize the bias and inefficiency associated with listwise deletion. Phillips & Chen (2011) examine the contributions of various factors to China's economic growth. They use the MI technique on panel data from 1978 to 1999 for 30 provinces, autonomous regions, and independently administered cities. The data are from various Chinese statistical publications compiled at the provincial level every year. They suggest that MI solves the data missing problem and that single imputation is inappropriate. Kammerer (2009), who studies the EP-innovations of German manufacturers of electrical and electronic appliances, states that missing data in logit regression is handled with listwise deletion. Therefore, the author has imputed missing values using the MI method by creating 10 data sets. Siche et al. (2008) offer a comparison between the two most used environmental sustainability indices of nations: “ecological footprint” and “environmental sustainability index”. They use the multiple imputation algorithms to substitute missing data.

In MI, each set of imputations creates a complete data set. The first step of multiple imputations is to estimate multiple values for each missing datum. This simulates multiple random draws from the data in order to estimate the unknown parameter whereby, each of the data set can be analyzed using standard complete data analysis (Schreuder & Reich, 1998). According to Carlin et al. (2008), multiple imputations include multiple copies of original data and imputations of missing values as required by the researcher. Accordingly, this method has two general stages. The first stage is the creation of set copies with the original data set and the generation of missing values using an appropriate modeling procedure. Then, any standard analysis can be performed with the new imputed data set. Multiple imputations can be performed without a model or can be based on a model determined by the researcher. However, researchers prefer a model based approach compared to the imputations done without a model (Cameron & Trivedi, 2005). In the regression based model approach, multiple imputations are done through a process of iterations. That is, missing values are iteratively generated based on the observed variables (Carlin et al., 2008).

Data and Methodology

This study verifies the effect of population change, the distance to CBDs, ALV, LUCT, property tax savings and FVTR on the proportion of land enrolled in the New Hampshire CU program. The Department of Revenue Administration in New Hampshire (NHDRA) maintains comprehensive information related with CU taxation at the town level. After eliminating some possible outlier towns, 231 towns were considered for the analysis. The towns not included for the analysis are New Castle, Hart's location and New Fields. We obtained the information on CU acres, FVTRs, assessed value of land, total land area, LUCTs in each town for the period 1999-2009 using NHDRA annual reports and CU reports. Then, we combined above data with population statistics obtained from the U.S. Census. The economical and developmental influence received from Boston is considerable for most of the New Hampshire towns, especially in the Southern portion of the state. Therefore, we considered Boston as one of the Central Business Districts in the analysis, in addition to Manchester in New Hampshire. The distance to each business district to each town is from Google map data (maps.google.com). Also, we considered the presence of interstates (I-93, 89, 293, 393, Turnpikes) and US routes in towns as a proxy in understanding the development pressure for towns. The data was obtained from the New Hampshire Department of Transformation (DOT) traffic data. The averages Annual Traffic Data (AADT) were only available (online) for the years 2003-2010. Therefore, instead of using AADT, we used dummy variables to represent those interstates. The average assessed value of land (ALV_{it})in town is calculated as follows.

$$ALV_{it} = \frac{Residential\ land\ value + Commercial\ and\ industrial\ land\ value}{Total\ land - Non\,taxable\ conservation\ and\ CU\ land}$$

Model Specifications and Panel Data Analysis

Our model specifications are in two categories. Models 1-3 consider CU acres per thousand acres of land in town as the dependent variable and the models 4-6 consider CU acres removed as the dependent variable. The analyses were performed using the data obtained after ten imputations. The estimated models are as follows.

Dependent Variable (CU_{it}): CU Acres per thousand acres of total land acres in town

$$CU_{it} = \beta_0 + \beta_1 FVTR(Lag)_{it} + \beta_2 ALV_{it} + \beta_3 \Delta Pop_{it} + \beta_4 Bos_i + \beta_5 Manc_i + \beta_6 I_i + \beta_7 US_i + \varepsilon_{it} \quad (1)$$
$$CU_{it} = \beta_0 + \beta_1 LUCT_{it} + \beta_2 \Delta Pop_{it} + \beta_3 Bos_i + \beta_4 Manc_i + \beta_5 I_i + \beta_6 US_i + \varepsilon_{it} \quad (2)$$
$$CU_{it} = \beta_0 + \beta_1 Tax.Sav_{it} + \beta_2 LUCT_{it} + \beta_3 \Delta Pop_{it} + \beta_4 Bos_i + \beta_5 Manc_i + \beta_6 I_i + \beta_7 US_i + \varepsilon_{it} \quad (3)$$

Dependent Variable ($CURe_{it}$): CU Acres removed per 1,000 acres of CU in town

$$CURe_{it} = \beta_0 + \beta_1 FVTR(Lag)_{it} + \beta_2 ALV_{it} + \beta_3 \Delta Pop_{it} + \beta_4 Bos_i + \beta_5 Manc_i + \beta_6 I_i + \beta_7 US_i + \varepsilon_{it} \quad (4)$$
$$CURe_{it} = \beta_0 + \beta_1 LUCT_{it} + \beta_2 \Delta Pop_{it} + \beta_3 Bos_i + \beta_4 Manc_i + \beta_5 I_i + \beta_6 US_i + \varepsilon_{it} \quad (5)$$
$$CURe_{it} = \beta_0 + \beta_1 Tax.Sav_{it} + \beta_2 LUCT_{it} + \beta_3 \Delta Pop_{it} + \beta_4 Bos_i + \beta_5 Manc_i + \beta_6 I_i + \beta_7 US_i + \varepsilon_{it} \quad (6)$$

Variable Description

$FVTR(Lag)$: Full Value Tax Rate (1 year lagged)
$LUCT$:Land Use Change Tax per acre of CU Removed
ALV : Average Land Value
ΔPop : Change in population (for thousand)
Bos : Distance to Boston
$Manc$: Distance to Manchester
I or US : Presence of Interstate (Dummy) or Presence of US Route (Dummy)

Results and Discussion

We first focus on the missing data issue in the data before proceeding to detailed analyses. Only 70 percent of the observations reported had no missing data, whereas about 30 percent of observation had at least one missing value. Most of the missing data were found in the variables CU removed and LUCTs. Cases of missing data for those two variables were easily observable. According to New Hampshire CU law, a land withdrawn from the program is subjected to a penalty of 10 percent of market value and this is known as Land Use Change Tax (LUCT). Therefore, the CU acres removed and LUCT should have been reported for any observation, if any land is withdrawn. However, in the data set, there were some observations with one of those values missing. It was clear that, if either LUCT or CU removed data was missing; the data was missing due to non-reporting. Therefore, a method to replace those missing values was important rather than simple listwise deletion of observations with missing data. The analyses were done after the ten imputations performed to treat the missing data.

According to theoretical predictions in the CU literature, we hypothesized an increase in CU enrollment in towns closer to Manchester and Boston, with higher FVTR, tax savings, LUCT, and ALV. Also, we expected increase in CU enrollment with relation to ease in commute to cities, i.e. presence of an interstate route or a US route. Similarly, we hypothesized a decrease in CU enrollment in towns with higher population growth.

As expected, there is a significantly high CU enrollment in towns with high FVTR, high ALV and high tax savings (models 1-3). Also as expected, towns with high population growth have a lower enrollment in the program. However, it is not significant. As expected, it may be difficult to capture the effect of population growth effect on CU land proportion in the program. This is because new population may not necessarily settle only in CU land. Rather, they may be settling in already developed land or in lands that are not entitled for preferential tax benefit.

We hypothesized an increase in CU enrollment in towns closer to Boston and Manchester. As predicted, there is a significant increase in CU enrollment in towns closer to Manchester (models 1 and 2). Therefore, we can conclude that land owners closer to Manchester are likely to enroll their land in the CU program to receive the preferential tax benefit on their undeveloped land. When considering the influence of Boston on CU land proportion, we get contrasting results. According to models 1 and 2, an increase in distance to Boston results in an increase in proportion of land in the CU program. This contradicts the hypothesis we made earlier. However, our third model results support our hypothesis, showing an increase in CU enrollment in towns closer to Boston (model 3).

Also, we considered the factors that could lead to CU withdrawal. As hypothesized, there is a lower instance of CU withdrawal in towns with higher CU tax savings (model 6) and higher ALV (model 4). As expected, all the models (4-6) show higher CU withdrawal for metropolitan uses in towns further away from Manchester compared to the towns closer to the Manchester area. When considering the effect of LUCT on CU withdrawal, we have contrasting results from the models we considered in the paper. According to our results, some towns with higher LUCT have a lower withdrawal, whereas some other towns have a higher CU withdrawal.

We focused on verifying the effects of population change, average land value (ALV), full value tax rate (FVTR), tax savings from CU enrollment, land use change tax (LUCT), presence of interstate or a US route and the distance to CBDs on the proportion of acres of land enrolled in the CU Property Tax (CUPT) program for the period 1999-2009 in 231 New Hampshire towns. Our results prove a couple of hypotheses. As expected with the current use laws in New Hampshire, the landowners are more inclined to enroll their land in the CU program if they gain higher tax benefits from enrollment, if property tax rates and land values are higher and if the land parcel is located close to Manchester. Those results are statistically significant. Our results suggest contrasting conclusions about the CU withdrawal penalty, i.e. LUCT. That is, models 3 and 5 suggest an increase in enrollment and lower CU removal in towns with higher LUCT. However, models 2 and 6 predict lower enrollment and higher CU removal with higher LUCT. Therefore, it is questionable whether LUCT in New Hampshire brings the intended delay in land development for metropolitan uses. Overall, our results suggest that the CU program in New Hampshire is effective in delaying land conversion to residential or commercial development.

Policy Suggestions

CU programs intend to postpone tax-induced land development. However, program features could lead to differences in program effectiveness. One of the mostly discussed features is the difference in CU withdrawal penalties. According to England and Mohr (2003), declining CU withdrawal penalties with the length of enrollment are effective in delaying land development. CU penalties can either increase or decrease depending on the market conditions and penalty structure etc. In New Hampshire (NH), CU penalty structure is a constant (10%) fraction of market value. This does not depend on the length of enrollment. Therefore, a landowner will not get any additional benefit by enrolling the land for a longer period. There is no incentive for a NH landowner to keep the land enrolled in the program for a longer period. Therefore, we would like to suggest a CU withdrawal penalty that declines with the length of enrollment (sliding-scale market value penalty), in order to delay detrimental land development in New Hampshire.

References

American Farmland Trust (2004). *Cost of Community Services Studies* , American Farmland Trust, Farmland Information Center., Washington, D.C.

Anderson, J.E. 1986, "Property Taxes and the Timing of Urban Land Development", *Regional Science and Urban Economics,* vol. 16, no. 4, pp. 483-492.

Anderson, J.E. & Griffing, M.F. 2000, "Use-Value Assessment Tax Expenditures in Urban Areas", *Journal of Urban Economics,* vol. 48, no. 3, pp. 443-452.

Brockett, C.D., Gottfried, R.R. & Evans, J.P. 2003, "The Use of State Tax Incentives to Promote Forest Preservation on Private Lands in Tennessee: An Evaluation of Their Equity and Effectiveness Impacts", *Politics & Policy,* vol. 31, no. 2, pp. 252-281.

Cameron, A.C. & Trivedi, P.K. 2005, *Microeconometrics: Methods and Applications,* Cambridge and New York:; Cambridge University Press.

Capozza, D.R. & Helsley, R.W. 1989, "The fundamentals of land prices and urban growth", *Journal of Urban Economics,* vol. 26, no. 3, pp. 295-306.

Carlin, J.B., Galati, J.C. & Royston, P. 2008, "A new framework for managing and analyzing multiply imputed data in Stata", *The Stata Journal,* vol. 8, no. 1, pp. 49-67.

Carter, R.L. 2006, "Solutions for Missing Data in Structural Equation Modeling", *Research & Practice in Assessment,* vol. 1, no. 1.

Daiheng, N., Leonard, J.D., Guin, A. & Feng, C. 2005, "Multiple Imputation Scheme for Overcoming the Missing Values and Variability Issues in ITS Data", *Journal of Transportation Engineering,* vol. 131, no. 12, pp. 931-938.

England, R.W. & Mohr, R.D. 2003, "Land Development and Current Use Assessment: A Theoretical Note", *Agricultural and Resource Economics Review,* vol. 32, no. 1, pp. 46-52.

Ferguson, J.T. & Spinelli, M.A. 1998, "Measuring the effectiveness of use value taxation", *Assessment Journal,* vol. 5, no. 5, pp. 56-62.

Honaker, J. & King, G. 2010, "What to do About Missing Values in Time Series Cross-Section Data", *American Journal of Political Science,* vol. 54, no. 3.

Kammerer, D. 2009, "The Effects of Customer Benefit and Regulation on Environmental Product Innovation: Empirical Evidence from Appliance Manufacturers in Germany", *Ecological Economics,* vol. 68, no. 8-9, pp. 2285-2295.

Kashian, R. 2004, "State Farmland Preferential Assessment: A Comparative Study", *Journal of Regional Analysis and Policy,* vol. 34, no. 1, pp. 1-12.

Malme, J. 1993, *Preferential Property Tax Treatment of Land*, Lincoln Institute of Land Policy.

Morris, A.C. 1988, " Local Government Tax and Land Use Policies in the United States: Understanding the Links " in *Property Tax Treatment of Farmland: Does Tax Relief Delay Land Development?*, ed. H.F. Ladd, Edward Elgar, Northampton, MA, pp. 144-167.

Norman, C.S. 2009, "Rule of Law and the Resource Curse: Abundance versus Intensity", *Environmental and Resource Economics,* vol. 43, no. 2, pp. 183-207.

Parks, P.J. & Quimio, W.R.H. 1996, "Preserving Agricultural Land with Farmland Assessment: New Jersey as a Case Study", *Agricultural and Resource Economics Review,* vol. 25, no. 1, pp. 22-27.

Phillips, K.L. & Chen, B. 2011, "Regional Growth in China: An Empirical Investigation Using Multiple Imputation and Province-Level Panel Data", *Research in Economics,* vol. 65, no. 3, pp. 243-253.

Polyakov, M. & Zhang, D. 2008, "Property Tax Policy and Land-Use Change", *Land Economics,* vol. 84, no. 3, pp. 396-408.

Royston, P., Carlin, J. & White, I. 2009, "Multiple imputation of missing values: New features for mim", vol. 9, no. 2, pp. 252-264.

Rubin, D.B. 1996, "Multiple Imputation After 18+ Years", *Journal of the American Statistical Association,* vol. 91, no. 434, pp. pp. 473-489.

Rubin, D.B. 1996, "Multiple Imputation After 18+ Years", *Journal of the American Statistical Association,* vol. 91, no. 434, pp. pp. 473-489.

Rubin, D.B. 1996, "Multiple Imputation After 18+ Years", *Journal of the American Statistical Association,* vol. 91, no. 434, pp. pp. 473-489.

Schreuder, H. & Reich, R.M. 1998, *Data Estimation and Prediction for Natural Resources Public Data*, United States Department of Agriculture.

Siche, J.R., Agostinho, F., Ortega, E. & Romeiro, A. 2008, "Sustainability of Nations by Indices: Comparative Study between Environmental Sustainability Index, Ecological Footprint and the Emergy Performance Indices", *Ecological Economics,* vol. 66, no. 4, pp. 628-637.

Stienbarger, D.2004, "*Do You Qualify for Reduced Property Taxes? – Current Use Taxation*. *Small Acreage Program*. *Clark County Extension*, Washington State University.

Wayman, J.C. 2003, "Multiple Imputation For Missing Data: What is it and How Can I Use it? ", *2003 Annual Meeting of the American Educational Research Association*.

William, D., Gottfried, R., Brockett, C. & Evans, J. 2004, "An Integrated Analysis of the Effectiveness of Tennessee's Forest Greenbelt Program", *Landscape and Urban Planning,* vol. 69, pp. 287-297.

Tables

Table 1: CU Acres in New Hampshire

Year	CU Acres	CU %
1999	2,803,462	52.66
2000	2,811,203	52.80
2001	2,806,783	52.72
2002	2,769,443	52.02
2003	2,744,020	51.54
2004	2743,971	51.54
2005	2,744,020	51.54
2006	2,720,822	51.11
2007	2,721,722	51.12
2008	2,701,589	50.75

Table 2: Current Use Assessment for Different Parcels in New Hampshire

Description of Eligible Lands		Assessment Range /Acre
Farm Land		
Forage	Sod	
Grains	Floral Products	
Fruits	Pasturage	$25.00-425.00
Vegetables	Fiber	
Herbs	Oilseeds	
Plantation Christmas Trees	Short-rotation tree fiber farming	
Nursery Stock		
Forest Land		
(No documented stewardship)		
White Pine	(Stewardship documentation may consist of either	$112-170
Hardwood	tree farm certification or a management plan	$55-84
Other	prepared by a licensed NH forester.)	$91-137
(With documented stewardship)		
White Pine		$63-115
Hardwood		$15-36
Other		$44-87
Unproductive Land	Includes unimproved lands upon which there are no structures, are incapable of producing agricultural or forest crops, and are being left in the natural state without interference with natural ecological processes.	$15
Wetlands	In addition to the wetland area itself, a buffer of 100 feet shall be allowed, provided that the land within the buffer is unimproved and in a natural state.	$15
Gross income of $2,500	During the previous year, it shall be demonstrated that at least $2,500 gross income was generated from the sale of crops grown on the land. Lands will be classified as either farm land or contiguous land (not involved in income generation, but is farm land, forest land or unproductive land) regardless of acreage.	(Assessment values depend on the type of land classification and respective proportions of land classification. Above rates apply)

Source: SPACE, 2007

Table 3: Summary Statistics

Variable		# of Obs.	Mean	Std.Dev.	Minimum	Maximum
Land	CU	2541	11918.91	11187.69	192.11	154925.60
	CU removed	1843	138.45	940.77	0.04	14940.63
	Rural	2526	14644.17	13772.61	0.00	159185.10
LUCT	Actual	1930	58792.51	103752.40	15.00	1480559.00
Distance	Boston	2541	99.78	41.68	33.90	218.00
	Manchester	2541	57.67	35.66	0.00	167.00
Land Value	Average	20494.65	32199.22	112.15	806186.90	20494.65
Property Tax	FVTR(t)	2537	18.23	5.05	5.40	41.10
	Average Value	2523	340.82	473.02	0.61	12489.60
	Current Use (Acre)	2530	1.93	0.96	0.27	18.27
	Savings per acre	2523	338.89	472.86	0.14	12489.00
Population Change (per 1000)		2509	11.54	22.58	-170.47	139.07

Table 4: Summarized Hypotheses and Results

		Results Support (Yes, No)/ Significant(*)		**Results Support (Yes, No)/ Significant(*)**
FVTR	**>0**	Yes, *	**<0**	No*
Tax Savings	**>0**	Yes, *	**<0**	Yes
LUCT	**>0**	No/Yes	**<0**	Yes/No
ALV	**>0**	Yes *	**<0**	Yes
Population Change	**<0**	Yes	**>0**	Yes/No
Distance to Boston	**<0**	No */Yes	**>0**	Yes/No
Distance to Manchester	**<0**	Yes*	**>0**	Yes
Interstate in town	**<0**	Yes/No*	**>0**	Yes/No
US route in town	**<0**	Yes*	**>0**	Yes

Table 5: Regression Results (After 10 Imputations)

	Dependent Variable					
	CU land area/10,000 acres			CU land removed/1000 CU acres		
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Variable	**Coeff.** **[P>lz]**	**Coeff.** **[P>lz]**	**Coeff.** **[P>lz]**	**Coeff.** **[P>lz]**	**Coeff.** **[P>lz]**	**Coeff.** **[P>lz]**
FVTR(lag 1)	1.398 *** [0.000]			37.864 * [0.085]		
Tax Savings per acre			0.016 *** [0.001]			-0.118 [0.292]
LUCT(lag1) in 10,000s per acre of CU removed		-1.50E-05 [0.348]	4.80E-06 [0.464]		-0.001 [0.423]	0.000 [0.585]
ALV	2.931 *** [0.000]			-20.841 [0.335]		
Population Change (per 1000)	-0.057 [0.267]	-0.030 [0.493]	-0.044 [0.291]	5.394 [0.627]	-5.956 [0.616]	2.237 [0.820]
Distance to Boston	4.097 *** [0.000]	3.985 *** [0.000]	-6.578 [0.854]	0.174 [0.955]	-85.558 [0.538]	-43.862 [0.694]
Distance to Manchester	-2.881 *** [0.001]	-2.839 *** [0.001]	-10.108 [0.728]	5.027 [0.292]	120.457 [0.276]	104.737 [0.250]
Interstate (Dummy)	-6.488 [0.845]	-5.977 [0.859]	4.111 *** [0.000]	-19.932 [0.867]	1.066 [0.744]	0.620 [0.818]
US Route (Dummy)	-10.092 [0.708]	-9.290 [0.734]	-2.909 ** [0.002]	127.558 [0.188]	3.166 [0.429]	3.055 [0.393]
Constant	235.604 *** [0.000]	277.160 *** [0.000]	262.346 *** [0.000]	-537.330 [0.246]	305.539 [0.291]	205.297 [0.365]

Figures

Figure 1: CU Land Percentages in NH Counties

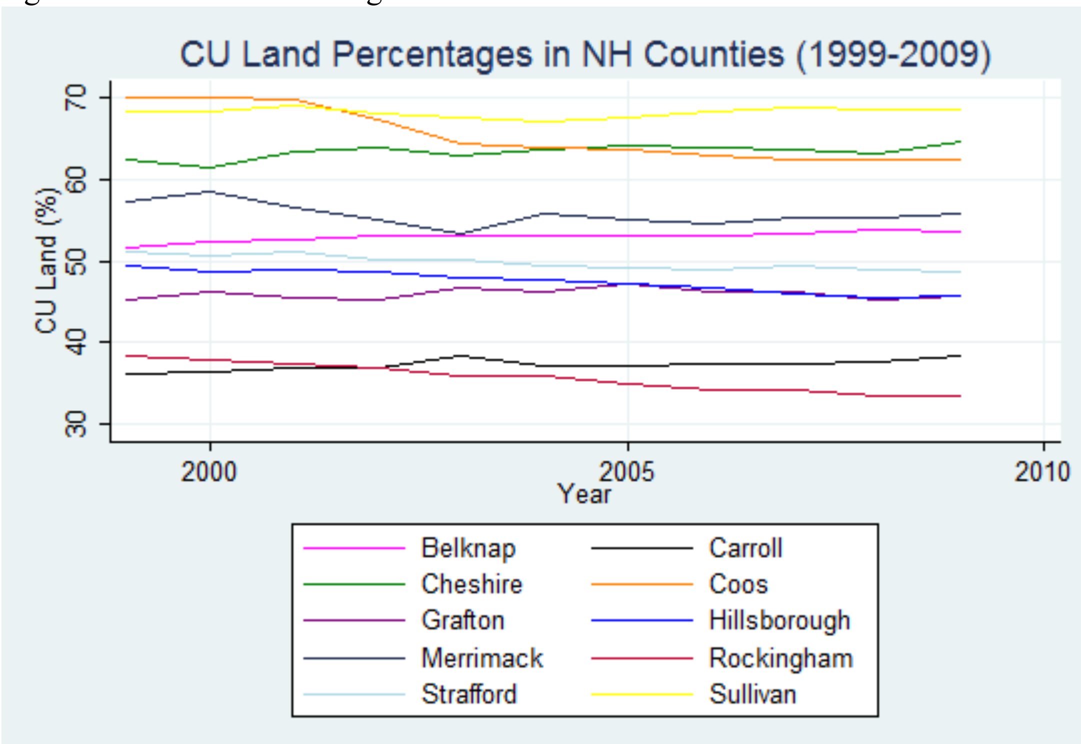


Figure 2: Percentage of CU Land Removed in NH Counties

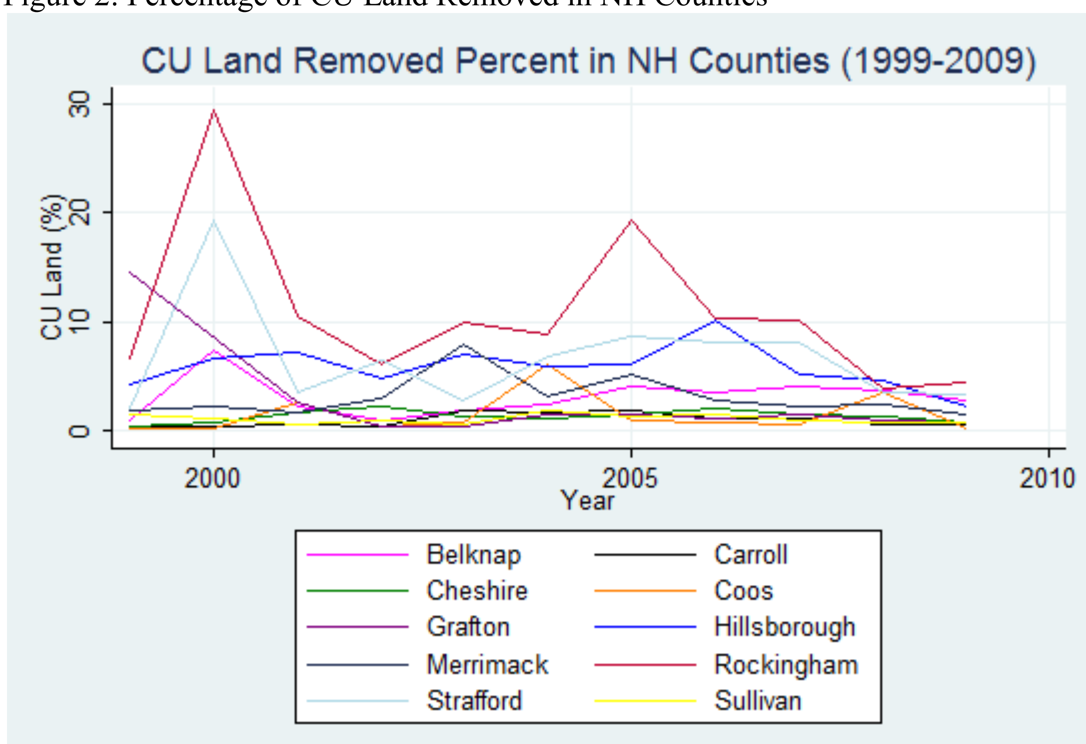
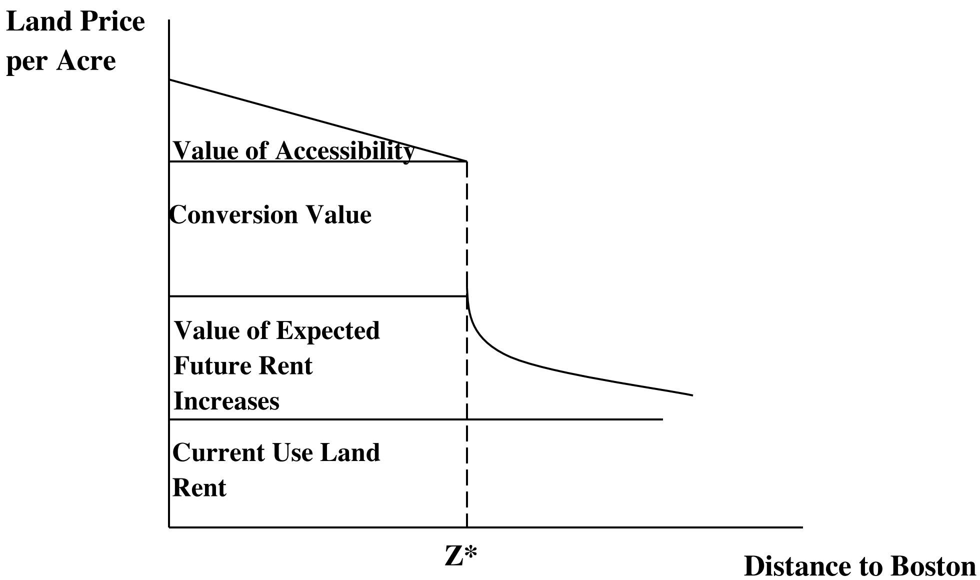


Figure 3: Determinants of a Land Value



Sources: Anderson (1986) and Cappoza & Helsley (1989)

Figure 4: Effect of Change in Population on Land Allocation