REFERENCES

Connecticut's Land Value Taxation Public Act: Who Would Bear the Burden?

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Abstract

Land value taxation or split-rate taxation (SRT) in Connecticut is close to reality with Public Act 15-184. We simulate short-run tax burdens for property owners in two Connecticut cities when moving from a uniform property tax to SRT. We examine whether higher valued property owners face higher tax increases when moving to SRT. A major contribution is our examination of horizontal equity with revenue-neutral SRT in a city's sub-sections, which this Connecticut legislation allows. We find the shift in tax burden among property classes is unique to individual neighborhoods. This highlights the importance of considering city sub-sections for implementing SRT.

Many moderate- to large-sized U.S. cities, including several in the Midwest (e.g., Detroit and St. Louis) and in the Northeast (e.g., Bridgeport, CT and Camden, NJ), have been facing increasingly greater amounts of vacant land, blighted property, and undeveloped land in the urban core. In these cities, real estate values have stagnated at best, and in the majority of cases (especially in Detroit), have plummeted in recent years (Davis and Palumbo, 2007). In a 2014 column in *The Boston Globe*, Harvard University economist Ed Glaeser suggested a solution that was originally proposed by the late-19th century economist, Henry George (1879): ''…taxing buildings to some degree discourages new building. Under a land tax, in contrast, a developer pays the same amount if the land is used for a parking lot, a single-family house, or a soaring skyscraper'' (Glaeser, 2014).

One implied goal of Glaeser's (2014) suggestion is to raise the capital-to-land ratio. When individuals are faced with a real estate tax on something that can be changed, these taxpayers will often modify their behavior to avoid the tax. A classic historical example was the ''window tax'' during the 18th and 19th centuries in England, where the tax bill was based on the number of windows in a property. This tax encouraged property owners to board up or cement over some or all of the windows in their property to avoid paying taxes (Oates and Schwab, 2015).

Land value taxation (LVT), which is sometimes also proposed in the form of a split rate or graded tax (SRT), levies two separate tax rates on real estate: one rate on land and a lower rate (SRT) or zero rate (LVT) rate on improvements.

Lowering a tax rate on something that can be changed—the amount of development on a parcel of land—is one approach to encourage real estate development. At the same time, the amount of land in a particular location (such as the city of Detroit) is fixed, so raising the tax on land has no impact on the amount of land. Such an approach can also mitigate sprawl and encourage urban revitalization, which can be a more efficient form of real estate development due to the pre-existence of costly infrastructure in the urban core that would need to be newly constructed for additional development to occur in the periphery.[1]

In addition to the potential effects on real estate development of a LVT, George (1879) originally proposed the LVT as an approach to enhance equity. He argued that land is a natural resource from which some people should not be able to profit, and a LVT would be a more equitable form of taxation than most other taxes.

SRT has been implemented in several U.S. cities, including Pittsburgh and Harrisburg, PA and parts of Hawaii (Cohen and Coughlin, 2005), and internationally in Australia and New Zealand (Andelson, 2001). In addition, it has been proposed in other locations, including Philadelphia, PA, parts of Virginia, and very recently, in the state of Connecticut. In this paper, we examine the issue of horizontal and vertical equity for two cities in Connecticut. Other studies of land value taxation equity (e.g., England and Zhao, 2005; Bowman and Bell, 2008) have primarily focused on how the tax payments would change for different quartiles of property values in an entire city. In other words, they find that a land value tax would be regressive (or progressive) for the entire city based on ordering of property values by percentiles. In addition to examining vertical incidence of moving to a LVT in these cities, our contribution is that we study horizontal equity across different types of properties assuming a SRT were to be implemented only in various neighborhoods in the cities. This approach enables us to determine which types of properties would face higher (or lower) total tax bills with a SRT in one or more of those neighborhoods, while keeping total tax revenues unchanged from their current levels in each of these neighborhoods. In other words, with the overall city approach, it might be more tempting to accept or reject a SRT based on the analysis of percentiles with vertical equity, but with our approach of examining individual neighborhoods we can determine for which neighborhoods a land value tax would impose greater or less burden on owners of each property class. Our approach could help policy makers select subsections of a city for a LVT depending on their preference for who should bear the property tax burden in the horizontal direction. These results can be of interest to other cities in the U.S., and throughout the world, that have been considering implementing a LVT (as described above).

The remainder of this paper continues as follows. First, we provide a detailed discussion of LVT, including a synopsis of the theory and empirical research on the topic. Next, we describe some recent legislation in the state of Connecticut that authorizes cities and towns to consider implementing a LVT, followed by a description of real estate tax incidence in the context of previous LVT studies and

in this study. Our simulations approach and description of the data for two Connecticut cities is next, followed by the simulation results and some conclusions.

Background on LVT and SRT

The virtues of moving local property taxes away from a uniform tax rate on land and structures toward a pure LVT while reducing or eliminating the tax on structures and possibly other taxes as well, have been elaborated upon by many (e.g., Tideman, 1982; Cohen and Coughlin, 2005; England, 2007; Oates and Schwab, 2009; Dye and England, 2010). Increasing tax rates on land, while at the same time eliminating distortionary taxes, is an idea that was advocated by George (1879). He was concerned with equity considerations of a LVT, since he believed land ''rents'' were not earned by landowners, they were unjustly benefitting from their ownership of the land. A tax on land rents would move society in the direction of a more fair distribution of tax burdens, George (1879) argued. More recently, Tideman (1982) discusses the neutrality of a LVT. Others, such as Oates and Schwab (2009) and Cohen and Coughlin (2005), present the theory of LVT[2] with supply and demand analysis, and demonstrate how moving from the current system of property taxation to a split-rate tax (SRT) would also have beneficial efficiency implications. In other words, moving from a conventional property tax (where land and buildings are taxed at the same rate) to a SRT would be expected to encourage economic development by decreasing the distortionary part of the property tax (that is, the tax on improvements). This could be accomplished while extracting land rents from landowners without distorting their decisions, which could encourage greater efficiency in markets overall and discourage sprawl. Building inward and upward in metropolitan areas is an efficient approach to economic development, and some of these authors have proposed that land taxation is one promising way to achieve this efficiency. This is because the supply of land is generally considered to be different from the supply for most other goods. In other words, regardless of the price of land, the supply of land remains fixed, so increasing a land tax will have no impact on the amount of land consumed in equilibrium. From a local taxation perspective, this is a desirable type of tax, since the tax on land does not affect decision-making in the market for land.

Oates and Schwab (2009) argue that by raising the tax on land, it would be possible to lower the taxes on other goods that do not exhibit the same characteristics as land. In other words, taxes on structures generally result in lower consumption levels of structures. So, lowering a tax on improvements to land should accomplish the opposite (i.e., raise consumption of the structures and encourage economic activity) while at the same time increasing the mill rate on land will potentially replace the lost revenue from the structures' tax cut in a way that does not discourage people from consuming land. So, moving to this SRT approach can be a win-win scenario. It improves efficiency and encourages

economic activity in the structures market while at the same time the higher land tax can be designed in a manner that does not lower overall tax revenues, thereby overall efficiency would be improved.[3]

There have been relatively few published academic U.S. studies on LVT using econometrics techniques, primarily because there are a small number of locations that have had lengthy experiments with LVT.[4] Due primarily to the lack of historical U.S. data, simulation studies have been more popular for assessing the distributive impacts of LVT and SRT.[5] In this study, we simulate SRT and LVT for two Connecticut cities, New Haven and New London.[6]

The remainder of this paper continues as follows. We provide some background on LVT legislation in Connecticut, followed by a discussion of tax incidence and LVT in previous studies. We then describe our methods, alternative scenarios, and data. We demonstrate that it is possible to devise a SRT for each of these cities leading to a residential tax incidence where the tax burden rises as residential property values rise. We also study the effects of a SRT on commercial, industrial, and vacant land owners' tax burdens, both overall and for several business districts in each of these cities. We conclude with some policy implications.

Background: Recent Land Value Tax Legislation in Connecticut

In 2008, the State of Connecticut ventured into its first recent attempt to implement land value taxation. New London was scheduled to complete its revaluation for the 2008 tax year. The city had been identified as a ''distressed municipality,'' and it was hoped that a split-rate tax would encourage economic development. New London had the option to study the impact of the split-rate tax and not adopt the program. New London would report back to the legislature the results of its study by December 2009, including the legal and administrative issues that it discovered. Eventually, New London opted not to adopt the split-rate tax. The opposition by those who stood to lose with the new configuration, plus the opposition by those who misunderstood the tax and simply opposed any new tax, overwhelmed the advocates of the program.

In 2011, the state legislature proposed expanding the split-rate program to up to three municipalities. Senate Bill 130 struck the ''distressed municipality'' requirement, and struck the language that otherwise limited the program to New London. According to Senator Martin Looney, who introduced the revisions, there were no cities or towns specifically contemplated by the legislation. As a result of our personal communications with New Haven's former assessor, we learned that the city was contemplating the split-rate option. Unfortunately, SB 130 never made it out of committee.

With the recent passage of Connecticut Public Act 13-247 in 2013, and more recently, Connecticut Public Act 15-184 in 2015, LVT and SRT in the State of

Connecticut has come one giant step closer to becoming a reality. The most recent legislation authorizes up to three municipalities in the state to implement a property tax scheme where land would be taxed at higher rates than improvements. As a first step of the process, the municipalities that are selected would each need to form a committee to design a LVT plan. Each of these municipalities was to complete this plan by December 2015. One required part of this plan was to determine which areas within each particular city or town would be subject to the LVT or SRT. This would be an important issue to be resolved, because politically the LVT or SRT may face challenges if it is a more regressive tax than the current form of property taxation. For this reason, a major focus of this study will be on tax incidence with a LVT or SRT.

As the December 2014 deadline approached for Connecticut Public Act 13-247, officials from one municipality—Bridgeport[7]—expressed interest to the State of Connecticut Office of Policy and Management (OPM), in considering participation in the LVT program. However, the lack of sufficient time to meet all requirements for the application process led the city council to vote for a request to extend the deadline (this information was obtained through our personal communications with OPM). This led to adoption of a virtually identical legislation, Connecticut Public Act 15-184, which effectively (with some minor modifications) extended the deadline of Connecticut Public Act 13-247 through December 31, 2015. Our simulation results for New Haven and New London generate some general insights that could be helpful to any Connecticut cities considering participation in this LVT program, with respect to the implications for vertical and horizontal property tax equity.

Land Value Taxation, Split-Rate Taxation, and Tax Incidence

A major practical concern regarding implementation of LVT and SRT is tax incidence. Schwab and Harris (1998) examine this issue for Washington, DC. They consider a variety of possible scenarios where a LVT or SRT is imposed in Washington, DC. These include a LVT where all property classes are taxed at the same property tax rate (which they describe as ''eliminate classification''); an equivalent tax rate on structures and land, while eliminating classification; a SRT where the tax rate on land is double the structures tax rate, and leaving classification in place while changing tax rates in the same proportions for all classes; a pure LVT, with the tax bill for each class remaining unchanged; and a hybrid of the prior two scenarios (i.e., a SRT that changes the tax rate on land to be double the structures rate, but leaving tax liabilities unchanged for each class). For all of these five scenarios, they allow for some form of change in the Homestead exemption—either elimination in the first two scenarios or a higher exemption for structures than for land in the last three scenarios. One of their key findings is that it would be possible to devise a progressive, revenue neutral split tax for Washington, DC. In other words, for some of these scenarios, they find

that the tax bills for residents in Southeast DC are lower under the proposed land tax alternatives, while tax bills for residents in several other parts of DC are higher. Since average incomes are lower in many of the Southeast neighborhoods of DC than in other areas of the city, this implies that the Schwab/Harris land tax proposal for land taxation in DC would be progressive. More of the burden of the SRT and LVT would fall on property owners in neighborhoods with residents who had higher incomes.

Another relevant, more recent simulation study on the distributive effects of a land tax is England and Zhao (2005), who analyze the town of Dover, New Hampshire. Their use of the word ''progressive'' is slightly different than Schwab and Harris (1998). England and Zhao consider a SRT or LVT to be ''progressive'' if higher-valued property owners face higher tax bills with the move to the SRT or LVT. This measure of progressivity is consistent with standards of professional assessment practices (Eckert, 1990). They find that while a move to a progressive split tax may be elusive, it would be possible to offer property tax credits that would lead to a progressive outcome. Specifically, they find that residents of Dover with higher-priced homes would face lower tax bills with a LVT or SRT, while the higher tax rate on land would lead to residents with lower-priced homes owing more taxes. Moreover, the magnitude of these tax bill changes for both groups would be more pronounced as the tax rate on land rises. To overcome this obstacle to progressivity, they propose considering a tax credit, which would vary from $250 up to $2,000, depending on the magnitude of the SRT or LVT. While this has the potential to resolve the progressivity issue for the highest tax rate on land, it leads to higher tax bills for most homeowners (as they do not allow tax bills to be negative with the credit), which may be politically infeasible. As an additional alternative, England and Zhao consider a SRT for single-family homes, and find that if the structures tax were lowered to $10.98 along with a $1,000 tax credit, it would be possible to raise the land tax in such a manner that approximately 80% of the middle- and lower-priced homeowners would face lower tax bills. Condominium owners would face lower tax bills on average with a similar SRT that is coupled with a tax credit. For industrial and commercial properties, the results appear to be mixed, in the sense that approximately half of these properties would face higher tax bills. While this could help garner political support from homeowners for a SRT, at the same time it could deter businesses from operating in Dover. The bottom line of England and Zhao, however, is that it is possible to achieve progressivity in Dover when imposing a SRT as long as it is accompanied by a tax credit.

Bowman and Bell (2008) study Roanoke, Virginia and examine the progressivity issue for the entire town using a few different approaches. First, with the approach of England and Zhao (2005) of comparing tax bills for different values of residential properties, Bowman and Bell do not find progressivity. But when calculating the percentage changes in tax burdens for properties in three different groups of property values, they find higher percentage changes in tax bills for higher-valued properties, implying evidence of progressivity. They also examine

average incomes in various Census block groups compared with average tax bills in those block groups, and find higher tax increases with the SRT in block groups with higher average incomes.

Approach

In this study, we focus on two Connecticut cities, New Haven and New London. Assessment data from New Haven, as well as a data set for New London are used. We obtained property assessment data for all properties in New London and New Haven from each city's ''Grand List.'' Since New Haven re-assessed in 2011 and New London re-assessed in 2013, using the most recently available assessment data is important.[8] We also obtained current property tax rates, known as ''mill rates'' in Connecticut, for both cities and for each special taxing district for both cities.

As a part of preliminary analysis, we also obtained Grand List data from some other cities in the state. These cities are Norwalk and Waterbury. Our choice to focus on New London and New Haven is based on the following. First, after examining the Norwalk Grand List data, we found the Norwalk data to be in an unsuitable format for our analysis. Second, based on personal communications with the City of Waterbury assessor and his staff, we learned that Waterbury is unlikely to consider participating in the state's LVT pilot program. Therefore, we decided to focus on New London and New Haven.

New London is an interesting case study because in 2008–2009 it came closer than any other Connecticut municipality to adopting LVT. The current pilot program law, which allows for LVT or SRT to be implemented for a subset of properties in a municipality, may gain consideration by New London authorities, given that the city's current mayor supported LVT during his most recent campaign (*The Day*, 2014). Also, while there was opposition from commercial property owners in New London in 2008–2009, our findings include that the commercial property owners in the New London Central Business District (CBD) would see lower tax bills with a split tax, compared with the current single-rate system.

New Haven is one of the largest cities in Connecticut and the location of Yale University. New Haven is currently the largest recipient of Payments In Lieu of Taxes (PILOTs) in the State of Connecticut (Kenyon and Langley, 2010), most of which comes from Yale University. Based on our recent communications with the former assessor of New Haven, in the past New Haven had been interested in considering LVT and SRT under some of the previous Connecticut legislation that limited participation to distressed municipalities. For these reasons, we decided to focus on New Haven as the second city of our analysis. Also, New Haven is a relatively large city that is similar in some ways to at least one other larger city, such as Bridgeport. This focus could provide a template for the other larger Connecticut cities (such as Bridgeport) to follow in pursuing the application process for the LVT pilot program.

One aspect of our approach—the consideration of vertical incidence of the implementation of LVT in each city overall—is similar to England and Zhao (2005) and Bowman and Bell (2008). Their analyses can be considered ''short-run'' simulations because in the long-run, any changes in property tax incidence could be expected to also affect prices.[9] We calculate the tax bill for each property of class (c) in a particular city with the current mill rates m_i (and m_i is the same for structures and improvements), which we call the ''base'' case. We denote the current tax bill for each property of class c as $T_{b,c,i}$, where $T_{b,c,i} = m_i * A_i$, and A_i is the total assessed value (for the sum of land and structures) of property i. In most Connecticut cities (with the exception of Hartford), assessed values for all real estate properties are based on 70% of market values; we denote assessed value for property i, $A_i = 0.70 * M_i$, where M_i is the market value of the property. When we simulate a SRT, we denote $m_{i,L}$ and $A_{i,L}$ as the mill rate and assessed value for land at property i, respectively, and $m_{i,S}$ and $A_{i,S}$ are the mill rate and assessed value, respectively, for structures at property i. A special case of this occurs when we include some scenarios where there is a LVT (i.e., $m_{i,S} = 0$), as well as other scenarios where there is a SRT (i.e., a graded tax structure where $m_{i,S} > 0$ but $m_{i,L} > m_{i,S}$). We re-calculate the tax bill for each property under a variety of different scenarios where the mill rates for land are higher than the mill rates for structures. We call this alternative x, with tax bill:

$$T_{x,c,i} = m_{i,S} * A_{i,S} + m_{i,L} * A_{i,L}, \tag{1}$$

where $x \in X$, $m_{i,L} > m_{i,S}$. X is the set of all scenarios considered. For both cities, all of these analyses are constructed in such a manner that the new mill rates lead to revenue neutrality.

Next, for each scenario in each city, we calculate the change in the tax bill for property i in class c, between the ''base'' case (denoted with the subscript ''b'') and alternative x:

$$\Delta T_{x,c,i} = (T_{x,c,i} - T_{b,c,i}). \tag{2}$$

We then aggregate the changes in tax bills for all properties i in class c, for the entire city, (as well as separately in some individual neighborhoods for the neighborhood-level simulations), n, for scenario x, where $\Delta T_{x,c,n} = \Sigma_{i \in n} \Delta T_{x,c,i}$. Finally, we divide $\Delta T_{x,c,n}$ by the total number of properties ($P_{x,c,n}$) in each class in the jurisdiction under consideration. Depending on the sign of $\Delta T_{x,c,n}$, the average tax burden of the city or neighborhood will either be higher with alternative x (if $\Delta T_{x,c,n}/P_{x,c,n} > 0$) or lower (if $\Delta T_{x,c,n}/P_{x,c,n} < 0$). We then calculate the average property value in each neighborhood n, and rank order these property

values to compare how higher (or lower) property values in neighborhoods in a particular class (c) fare with respect to the change in tax burdens. To ensure revenue neutrality of the proposed tax structures, for each alternative, x, we set the change in tax revenue, ΔR_x, equal to zero; in other words, aggregate revenue neutrality implies:

$$\Delta R_x = \Sigma_{c \in C} \Sigma_{n \in N} \Delta T_{x,c,n} = 0, \quad (3)$$

where N is the set of all neighborhoods (n) in a particular city and C is the set of all property classes (c) in a city.

We simulate[10] several scenarios, which are variations of the scenarios simulated by Schwab and Harris (1998), England and Zhao (2005), and Bowman and Bell (2008). These researchers consider aggregate revenue neutrality, and in addition Schwab and Harris (1998) consider scenarios where each class has a property tax bill that is unchanged by the land or graded tax. While Schwab and Harris (1998) and Bowman and Bell (2008) find a SRT in Washington DC and Roanoke, VA, respectively, can be progressive, England and Zhao (2005) identify some scenarios where the LVT or SRT is regressive. As a potential "solution," they propose a constant tax credit for all properties, which they show can lead to progressivity of a land tax. They also note, however, that an individual property owner's tax bill cannot be negative, so if the credit is sufficiently large so as to be greater than that property's land tax plus structures tax, that property would have zero impact on calculating the revenue neutrality for the entire city. We consider all of these scenarios (i.e., aggregate revenue neutrality); scenarios without uniform credits ($TC = 0$), and if/when it is difficult to find progressivity, uniform tax credits ($TC > 0$) to assess how this impacts the tax incidence of LVT or SRT in New Haven and New London.

Finally, it is noteworthy that the Connecticut Public Act 15-184 allows for municipalities to consider a subset of all neighborhoods, rather than implementing LVT for all properties in the municipality. New Haven and New London assess separate values for land ($V_{i,L}$) and improvements ($V_{i,S}$), although they currently levy the same mill rate on both. Tax revenues for property i (T_i) are the sum of the product of the mill rate on land and the land assessment, and the product of the mill rate on improvements and the improvements assessed value.

To summarize, for each scenario (x), we define $T_{x,c,n} = \Sigma_{i \in n} T_{x,c,n,i}$, where $T_{x,c,n,i}$ represents the tax bill for individual properties i in neighborhood n of property class c. Our sets of scenarios are as follows:

Scenario 1: Base case: Uniform mill rate for land and improvements at all properties, M_i (where $M_i = m_{i,L} = m_{i,S}$, and $V_i = V_{i,L} + V_{i,S}$):

$$T_i = t_M * M_i V_i, \text{ where } t_M = 0.70 \text{ for all properties.}$$

Scenario 2: $m_{i,L} > m_{i,S} > 0$, $TC = 0$ (SRT, no tax credits), $\Delta R_x = \Sigma_{c \in C} \Sigma_{n \in N} \Delta T_{x,c,n} = 0$ (aggregate revenue neutrality):

$$T_i = t_M * (m_{i,L} V_{i,L} + m_{i,S} V_{i,S}), \text{ where } t_M = 0.70 \text{ for all properties.}$$

Scenario 3: $m_{i,L} > m_{i,S} = 0$, $TC = 0$ (LVT, no tax credits), $\Delta R_x = \Sigma_{c \in C} \Sigma_{n \in N} \Delta T_{x,c,n} = 0$ (aggregate revenue neutrality):

$$T_i = t_M m_{i,L} V_{i,L}, \text{ where } t_M = 0.70 \text{ for all properties.}$$

Scenario 4: (only if Scenario 2 cannot lead to a progressive outcome) $m_{i,L} > m_{i,S} > 0$, $TC > 0$, $\Delta R_x = \Sigma_{c \in C} \Sigma_{n \in N} \Delta T_{x,c,n} = 0$ (SRT; aggregate revenue neutrality; uniform tax credit, TC):

$$T_i = t_M * (m_{i,L} V_{i,L} + m_{i,S} V_{i,S}), \text{ where } t_M = 0.70 \text{ for all properties.}$$

Scenario 5: (only if Scenario 3 cannot lead to a "progressive" outcome) $m_{i,L} > m_{i,S} = 0$, $TC > 0$, $\Delta R_x = \Sigma_{c \in C} \Sigma_{n \in N} \Delta T_{x,c,n} = 0$ (LVT; aggregate revenue neutrality; uniform tax credit, TC):

$$T_i = t_M m_{i,L} V_{i,L}, \text{ where } t_M = 0.70 \text{ for all properties.}$$

We consider the above scenarios for both cities, as well as for a variety of different neighborhood definitions. For New London, we consider the CBD, and all other properties. In New Haven, we examine these scenarios separately for the Chapel West, Downtown, Grand Avenue, and Whalley Avenue business districts, along with all other properties.

Data

The assessment date in the State of Connecticut is October 1. Assessment data for both New London and New Haven are based on the most recent assessment

Exhibit 1 | Descriptive Statistics

Land Use Category	Observations	Mean Assessed Value	Standard Deviation
Panel A: New London			
All Improved Parcels	6,494	$166,366	$756,890
Residential Condominiums	855	$61,522	$54,666
Single-Family Homes	1,582	$146,658	$428,682
Small Apartments	3,351	$126,618	$91,191
Apartments	92	$229,858	$97,795
Commercial	597	$576,701	$2,345,751
Industrial	17	$381,076	$337,554
Panel B: New Haven			
All Improved Parcels	23,334	$216,828	$1,084,721
Residential Condominiums	3,580	$116,986	$850,290
Single-Family Homes	9,206	$145,103	$116,102
Small Apartments	8,333	$132,441	$293,042
Apartments	444	$1,063,269	$3,582,627
Commercial	1,498	$920,769	$3,406,630
Industrial	261	$1,185,196	$2,994,354
Utility	12	$3,397,083	$9,681,652

date, October 1, 2013. All exempt properties were removed from the data analyzed. Connecticut municipalities are required to perform a revaluation at least every five years. New London completed its revaluation as of October 1, 2013; New Haven completed its most recent revaluation as of October 1, 2011. The 2012–2013 mill rates were used for both cities. For New London, the mill rate is $27.37. New London's CBD's added mill rate is $1.17. For New Haven, the mill rate is $41.55. For New Haven's tax increment finance districts, the mill rates are $2.50 for Chapel West, $1.88 for downtown (Town Green), $1.25 for Grand Avenue, and $1.75 for Whalley Avenue. In the simulations, revenue calculations are made before other tax incentives, like the tax abatement for Harbour Towers in New London. For New Haven, revenue calculations are made after any PILOT payments, like Yale's PILOT payments.

The descriptive statistics for the New London and New Haven data are in Exhibit 1. Note that condominiums do not have assessed value broken down for land and improvements, but residential, apartments, and commercial are separated into assessed values for land and structures. Based on the 2008 study completed by

Exhibit 2 | Assessed Values of Undeveloped Parcels: New London

Land Use Category	Observations	Mean	Std. Dev.
Commercial	102	$92,478	$201,244
Industrial	8	$211,768	$472,283
Condominium	—	—	—
Apartment	—	—	—
Residential	244	$59,603	$81,495
Land Use	1	$670	

the New London Assessor, we employ a factor for condominium properties of 38% of the total assessed value for land and 62% of the total for buildings. In future work, we may explore some possible alternative condominium land factors.

In New London, there are approximately 6,500 improved parcels, with a mean assessed value of approximately $166,000. Approximately 25% of New London's improved properties are single-family homes, and their mean assessed value is nearly $147,000. The percentage of single-family parcels in New London is significantly lower than in New Haven, which has about 40%. Only approximately 13% of the improved properties are residential condominiums, which have an average assessed value of $61,500.

As shown in Exhibit 2, there are approximately 360 vacant lots in New London, more than two-thirds of which are residential lots with a mean assessed value of $60,000. Approximately one-third of the vacant lots are for commercial properties, with a mean assessment of approximately $92,500.

In New Haven, there are approximately 23,300 improved parcels, with a mean assessed value of about $217,000. Approximately 40% of those parcels are single-family homes, which have a mean assessed value of $145,000. We disentangle the assessed value of land and structures for residential condominiums in the same manner as in New London. Specifically, condo land is assumed to equal 38% of the total assessed value for residential condominiums. There are roughly 3,600 residential condos, with a mean total assessed value of $117,000. There are 1,500 commercial structures, with a mean assessment of $920,000. The average commercial property is assessed at slightly under $1 million.

Among the more than 1,700 vacant parcels in New Haven, approximately two-thirds of these are residential and the other one-third are commercial (Exhibit 3). The average commercial lot is assessed at $126,500, while the average residential lot is assessed at $22,000.

It is clear from Exhibits 2 and 3 that New London has relatively few undeveloped parcels, but New Haven has a substantial number of such parcels. In particular,

Exhibit 3 | Assessed Values of Undeveloped Parcels: New Haven

Land Use Category	Observations	Mean	Std. Dev.
Commercial	422	$126,529.70	$311,097.93
Industrial	164	$155,029.82	$245,926.93
Condominium	1	$4,620.00	—
Apartment	2	$24,150.00	$6,370.00
Residential	1,138	$22,020.62	$27,718.93
Utility	1	$75,460.00	—

New Haven has approximately four times the number of undeveloped commercial and residential parcels as New London. In contrast, New London has merely 1/20th the number of industrial undeveloped parcels as New Haven.

Simulation Results

New London Results

We first perform our simulations exercise for all properties, ensuring revenue neutrality across all properties of all classes in the city. The current mill rate, M_i, is $27.37 per thousand dollars. We allow for several SRT scenarios in our simulations, including one where $m_{i,L} = 1.20\ m_{i,S}$, another where $m_{i,L} = 1.25\ m_{i,S}$, a third where $m_{i,L} = 1.30\ m_{i,S}$, and finally where $m_{i,L} > m_{i,S} = 0$ (LVT). The results of these simulations for single-family residential properties in New London are in Exhibit 4. We order the residential properties by total assessed value, and present the results in quartiles. There are several aspects of these results that are noteworthy. First, with the SRT (i.e., $m_{i,L} > m_{i,S} > 0$), while between 60% and 70% of residents would face higher tax bills, none of the residents in the first three quartiles would pay more than a 10% higher tax bill. Second, the SRT (and LVT) is progressive, analogous to the approach of England and Zhao (2005) when measuring tax burdens in dollars, mean, and median percentage changes. Residents who own lower-value properties face a lower tax bill increase than residents in higher value homes, and higher-value properties are a proxy for higher-income residents (Exhibit 5). In our context, this individual property-level approach is preferable to a Census block level measure of income because the latter aggregates all residential properties in the neighborhood, so it is possible that the tax bill changes for some very valuable and some low-valued residential properties are averaged into one number. This can mask some of the true heterogeneity in tax bill changes that is a result of LVT.

Exhibit 4 | New London Residential Properties: Two-Rate Taxation for Various Mill Rate Differences

	Mill Rate Variance between Land and Improvements			
	20%	25%	30%	No Building Tax
Building Rate	$25.57	$25.16	$24.76	—
Land Rate	$30.68	$31.42	$32.16	$77.63
1st Quartile				
Mean	$4.33	$4.94	$6.02	$63.97
Std. Dev.	$33.02	$40.44	$47.81	$501.56
Mean % Δ	0.17%	0.19%	0.23%	2.45%
Median	$11.82	$14.08	$16.84	$177.50
Median % Δ	0.54%	0.65%	0.77%	8.16%
% Positive	60.79%	60.63%	60.79%	60.79%
% > 10%	0.00%	0.00%	0.00%	44.89%
2nd Quartile				
Mean	$12.72	$15.14	$18.12	$191.06
Std. Dev.	$30.46	$37.31	$44.10	$462.68
Mean % Δ	0.52%	0.61%	0.73%	7.74%
Median	$12.94	$15.41	$18.44	$194.39
Median % Δ	0.52%	0.62%	0.73%	7.74%
% Positive	67.30%	66.72%	66.97%	66.97%
% > 10%	0.00%	0.00%	0.00%	47.28%
3rd Quartile				
Mean	$18.33	$21.93	$26.19	$275.84
Std. Dev.	$42.42	$51.96	$61.42	$644.36
Mean % Δ	0.63%	0.75%	0.89%	9.41%
Median	$13.41	$15.87	$19.03	$200.87
Median % Δ	0.48%	0.57%	0.68%	7.16%
% Positive	69.30%	68.97%	69.22%	69.30%
% > 10%	0.00%	0.00%	0.00%	41.40%
4th Quartile				
Mean	$96.02	$116.71	$138.43	$1,454.10
Std. Dev.	$249.05	$304.68	$360.38	$3,781.45
Mean % Δ	1.35%	1.64%	1.95%	20.49%
Median	$47.92	$58.08	$68.97	$724.85
Median % Δ	1.18%	1.43%	1.70%	17.90%
% Positive	70.53%	70.21%	70.45%	70.53%
% > 10%	0.00%	0.00%	3.29%	60.00%

Panel A of Exhibits 6 and 7 gives the overall simulation results for industrial and commercial properties, respectively. Although tax incidence is of interest for these property owners, progressivity among property owners in these classes is not as straightforward, and likely not as much of a concern as for residential properties. While 59% of property owners would see higher tax bills with all the various mill

Exhibit 5 | New Haven Residential Properties: Two-Rate Taxation for Various Mill Rate Differences

	Mill Rate Variance between Land and Improvements			
	20%	25%	30%	No Building Tax
Building Rate	$39.40	$38.89	$38.40	—
Land Rate	$47.26	$48.61	$49.90	$151.80
1st Quartile				
Mean	−$20.56	−$25.50	−$30.35	−$398.47
Std. Dev.	$39.88	$49.33	$58.37	$770.44
Mean % Δ	−0.68%	−0.84%	−1.00%	−13.14%
Median	−$30.37	−$37.63	−$44.69	−$587.93
Median % Δ	−1.23%	−1.53%	−1.81%	−23.86%
% Positive	22.24%	22.29%	22.29%	22.68%
% > 10%	0.02%	0.12%	0.28%	19.01%
2nd Quartile				
Mean	−$18.51	−$23.00	−$27.48	−$359.55
Std. Dev.	$63.34	$78.33	$92.67	$1,223.41
Mean % Δ	−0.52%	−0.65%	−0.08%	−10.10%
Median	−$6.07	−$7.62	−$9.28	−$119.29
Median % Δ	−0.15%	−0.19%	−0.23%	−2.92%
% Positive	45.90%	45.94%	45.90%	46.28%
% > 10%	0.00%	0.05%	0.09%	31.30%
3rd Quartile				
Mean	−$3.21	−$4.16	−$5.27	−$65.26
Std. Dev.	$81.60	$100.93	$119.41	$1,576.41
Mean % Δ	−0.06%	−0.08%	−0.10%	−1.18%
Median	−$1.59	−$2.12	−$2.89	−$33.36
Median % Δ	−0.03%	−0.04%	−0.06%	−0.67%
% Positive	48.18%	48.18%	48.13%	48.75%
% > 10%	0.05%	0.14%	0.35%	32.85%
4th Quartile				
Mean	$185.18	$228.69	$269.83	$3,571.41
Std. Dev.	$312.46	$386.36	$457.01	$6,034.58
Mean % Δ	1.54%	1.91%	2.25%	29.76%
Median	$126.97	$156.78	$184.94	$2,448.30
Median % Δ	1.42%	1.76%	2.07%	27.44%
% Positive	64.45%	64.45%	64.38%	64.57%
% > 10%	0.12%	0.05%	2.46%	57.92%

rate differences described above, none of the industrial properties in New London would face more than a 10% increase in their tax bills. In all of the SRT scenarios, fewer than 4% of commercial property owners would face a greater than 10% increase in their tax bills. No property owners would face more than a 10% increase in the scenario where land mill rates are only 20% higher than the

Exhibit 6 | Industrial Properties: Tax Payment Changes with Two-Rate Taxation

Panel A: New London: Mill rate variance between land and improvements				
	20%	25%	30%	No Building Tax
Building Rate	$25.57	$25.16	$24.76	—
Land Rate	$30.68	$31.42	$32.16	$77.63
Mean	$72.22	$86.60	$103.31	$1,087.69
Std. Dev.	$303.73	$371.64	$439.54	$4,611.93
% Positive	58.82%	58.82%	58.82%	58.82%
% > 10%	0.00%	0.00%	0.00%	58.82%
Panel B: New Haven: Mill rate variance between land and improvements				
Building Rate	$39.40	$38.89	$38.40	—
Land Rate	$47.26	$48.61	$49.90	$151.82
Mean	($246.98)	($418.75)	($585.46)	($13,454.92)
Std. Dev.	$6,819.73	$7,461.53	$8,140.93	$79,779.83
% Positive	37.79%	37.79%	37.79%	38.55%
% > 10%	3.82%	4.58%	7.63%	32.44%

improvements mill rate. There would be little variation between the tax bill increases for vacant landowners zoned as single-family residential, apartments, and commercial in New London, all of whom would face approximately $200 to $300 higher tax bills on average. Although the precise figures for the various classes of vacant landowners are not shown, these estimates are available from the authors upon request.

An additional approach to mitigate political and/or taxpayer resistance would be to focus on one of the business districts in these cities as a starting point for implementing LVT or SRT. Based on a recent editorial in *The Day* (2014), New London's mayor has expressed interest in experimenting with LVT in the CBD. Our results indicate the tax bills with a SRT would decrease dramatically on average for commercial property owners, by approximately $73 to $109, on average, across the various scenarios presented in Exhibit 8. We compare the average changes in tax burdens for commercial, condominiums, and other residential properties in our analysis of the CBD. First, there are an extremely small number of residential properties in the CBD, and for this reason we focus our attention on how the tax burden would shift across rather than within property classes. This horizontal equity consideration in a subsection of a city is a unique contribution of our research. Single-family residential property would face a less than $20 increase in their tax bills on average. Condominium owners' tax bills would rise by $250 to $380, depending on the differential between the land and

Exhibit 7 | Commercial Properties: Tax Payment Changes with Two-Rate Taxation

Panel A: New London: Mill rate variance between land and improvements				
	20%	25%	30%	No Building Tax
Building Rate	$25.57	$25.16	$24.76	—
Land Rate	$30.68	$31.42	$32.16	$77.63
Mean	($268.68)	($331.97)	($391.01)	($4,095.96)
Std. Dev.	$2,394.78	$2,944.44	$3,475.28	$36,435.02
% Positive	45.47%	45.47%	45.47%	45.47%
% > 10%	0.00%	1.34%	3.69%	29.19%
Panel B: New Haven: Mill rate variance between land and improvements				
Building Rate	$39.40	$38.89	$38.40	—
Land Rate	$47.26	$48.61	$49.90	$151.82
Mean	$813.43	$685.37	$560.97	($9,029.06)
Std. Dev.	$20,465.89	$20,734.10	$21,035.99	$88,688.22
% Positive	45.48%	45.48%	45.48%	45.48%
% > 10%	7.96%	8.96%	10.10%	40.33%

Exhibit 8 | New London: Average Tax Bill Changes in the CBD

		Mill Rate Variance between Land and Improvements			
	N	20%	25%	30%	No Building Tax
Building Rate		$31.48	$32.57	$33.53	—
Land Rate		$26.33	$26.05	$25.81	$135.41
Avg. Vacant Land	21	$243.55	$308.50	$365.33	$6,409.04
Single Family	3	$13.05	$16.53	$19.57	$343.33
Condominium	23	$253.45	$321.04	$380.18	$6,669.62
Small Apt.	7	$55.17	$69.88	$82.75	$1,451.71
Large Apt.	10	−$145.92	−$184.84	−$218.88	−$3,839.94
Commercial	127	−$72.65	−$92.02	−$108.97	−$1,911.69

structures mill rates, and small apartment owners would face only slight tax bill increases of $55 to $83. Vacant landowners would face an increase of approximately $300 on average, which might incentivize some of them to develop the land and stop holding vacant land for speculative purposes. A LVT would have more dramatic effects. The average condominium owner's tax bill would increase by over $6,600, the average single-family property owner would face a tax increase of $343, and the average commercial property owner's tax bill would fall by nearly $2,000. Due to these large changes in the tax burden from commercial to residential, the SRT alternatives are likely to be a politically more palatable approach to implementing LVT in New London's CBD.

New Haven Results

Once again, we perform our simulations for the overall set of New Haven properties, as well as for several business districts in the city. First, the current overall mill rate in New Haven, M_i, is $41.55 per thousand dollars. Our simulations allow for several scenarios, including several SRT scenarios: one where $m_{i,L} = 1.20\ m_{i,S}$, another where $m_{i,L} = 1.25\ m_{i,S}$, a third where $m_{i,L} = 1.30\ m_{i,S}$, and finally where $m_{i,L} > m_{i,S} = 0$ (a LVT). We perform these simulations for the entire city, as well as separately for each of four business districts.

The overall residential simulation results imply a progressive split tax. The average residential taxpayer would pay a lower tax bill with a SRT, and this average decrease is largest in the first quartile and becomes smaller in the second and third quartiles. The average residential property owner in the fourth quartile would pay higher taxes with the SRT being $185–$270 higher as the building and land rate differential increases from 20% to 25% and ultimately to 30%. Given that the lowest quartiles tax decreases are successively smaller in moving from the first to the third quartile, and the fourth quartile faces a higher tax bill on average, this implies a progressive nature of the SRT for residents in New Haven. We also observe similar tax burden patterns when measuring the difference in tax burdens with median and mean percentage changes.

The changes in tax burdens for industrial and commercial properties in New Haven overall are shown in Panel B of Exhibits 6 and 7, respectively. For the 3 mill rate differentials between land and buildings of 20%, 25%, and 30%, the average industrial tax bill falls by $247, $419, and $585, respectively. On the other hand, the average commercial tax bill would increase by $813, $685, and $561, respectively. For a LVT, the average tax bill would fall by over $13,000 for industrial properties and over $9,000 for commercial properties. The average reduction for commercial properties of over $9,000 is heavily weighted by five outliers. These outliers include a garage and office buildings, each of which has an extremely low land value assessment relative to improvement assessment.

For New Haven, we focus on four special tax business districts, with the number of single-family residential properties in each in parentheses: Chapel West (5);

Exhibit 9 | New Haven: Average Tax Bill Changes in Each of Several Neighborhoods

		Mill Rate Variance between Land and Improvements			
	N	20%	25%	30%	No Building Tax
Panel A: New Haven-Chapel West					
Building Rate		$40.22	$39.89	$39.58	—
Land Rate		$48.20	$49.86	$51.40	$249.44
Avg. Vacant Land	19	$781.39	$976.74	$1,157.43	$24,434.36
Single Family	5	($7.65)	($9.56)	($11.33)	($239.20)
Condominium	9	$376.44	$418.61	$457.62	$5,482.81
Small Apt.	20	($5.93)	($10.53)	($14.79)	($562.84)
Large Apt.	30	($240.03)	($300.04)	($355.55)	($7,505.90)
Commercial	75	$113.10	$112.07	($4,048.37)	($11.45)
Panel B: New Haven-Downtown (Town Green)					
Building Rate		$39.78	$39.35	$38.94	—
Land Rate		$47.66	$49.15	$50.57	$185.06
Avg. Vacant Land	64	$1,978.06	$2,462.49	$2,920.00	$46,476.76
Single Family	2	$12.76	$26.06	$38.62	$1,234.44
Condominium	220	$1,490.03	$1,595.36	$1,694.84	$11,165.46
Small Apt.	6	$198.29	$246.86	$292.73	$4,659.91
Large Apt.	12	($1,641.21)	($2,043.14)	($2,422.74)	($38,562.03)
Commercial	180	$771.22	$469.50	$184.54	($26,944.55)
Panel C: New Haven-Grand Avenue					
Building Rate		$40.06	$39.71	$39.37	—
Land Rate		$48.07	$49.61	$51.11	$223.64
Avg. Vacant Land	10	$201.06	$248.44	$294.54	$5,612.09
Single Family	1	($152.15)	($188.01)	($222.90)	($4,247.10)
Commercial	55	($27.53)	($34.01)	($40.32)	($768.33)
Industrial	4	($53.43)	($66.03)	($78.28)	($1,491.48)
Panel D: New Haven-Whalley Avenue					
Building Rate		$39.93	$39.54	$39.17	—
Land Rate		$48.07	$49.61	$51.11	$208.45
Avg. Vacant Land	8	$327.75	$404.99	$480.14	$8,385.67
Large Apt.	1	($53.54)	($66.16)	($78.44)	($1,369.97)
Commercial	87	($22.78)	($28.15)	($33.38)	($582.91)
Industrial	1	($334.70)	($413.58)	($490.33)	($8,563.59)

Downtown (2), also known as Town Green; Grand Avenue (1); and Whalley Avenue (0). These results are presented in Exhibit 9. The average single-family residence and apartments tax bills would decrease in Chapel West for all mill rate differential scenarios. In Grand Avenue, all improved property classes will see a lower tax bill on average, while there are no apartments and condominiums in this business district. In the Town Green business district, all property classes experience a tax bill increase, except owners of large apartments (whose tax bills will fall by $1,640, $2,043, and $2,422 for the 20%, 25%, and 30% mill rate differentials, respectively). In the Whalley Avenue business district there are no single-family residences, small apartments, or condominiums. Large apartments, commercial and industrial property owners would see their average tax bills decrease with a SRT. The average property tax bill for vacant land owners would rise in all business districts.

Given that the only residential properties in the Whalley Avenue district are large apartments, measures of tax incidence across residential property owners are not as meaningful as the impact of re-distributing the tax payments. In each variation of land mill rate and building mill rate, the tax burden is shifted from improved properties (large apartment, commercial, and industrial) to vacant land. When a separate land mill rate and building mill rate is proposed, the tax burden on vacant land increase is between 14% and 19%, on average. In a LVT proposal, the average burden increases by 80%. Because there are no residential tax burden redistribution policy issues, and because the tax shift impact is more heavily borne by land, the Whalley Avenue business district appears to be a strong contender for implementing the land value tax.

Except for one single-family home, New Haven's Grand Avenue district is highly similar to the Whalley Avenue district. Even with that single-family house, in each rendition of the SRT and the LVT, the tax base shift moves from improved properties to vacant parcels. And, in each rendition, the single-family home receives some tax relief. The observed single-family property value, $282,000, significantly exceeds the average assessed value of a New Haven residential property at $145,000 (Exhibit 1). So, some tax burden shift to this property overall would not impact overall tax incidence in New Haven. Like the Whalley Avenue district, the revised burden imposed by the imposition of SRT and LVT shifts from improved properties to vacant land. On average, vacant land sees a tax increase of between 14% and 19% where both a separate land rate and building rate are imposed. Like the Whalley Avenue business district, a SRT or LVT in the Grand Avenue district appears to be a strong prospect for successful implementation.

Conclusion

Due to the few cities in the U.S. that have experimented with LVT and SRT, there have been a small number of published academic empirical studies in the LVT literature [Oates and Schwab (1997) is an exception]. The lack of existing data

has led to greater popularity of simulation studies (e.g., England and Zhao, 2005; Bell and Bowman, 2008).

Given the relatively small impact on tax bills of a small differential between $m_{i,L}$ and $m_{i,S}$, and the potential incentive to encourage development, the results of this study have several implications. First, a small differential between $m_{i,L}$ and $m_{i,S}$ could be a starting point that has the potential to shift the tax burden from lower-value property owners to higher-value owners. Second, if the municipalities choose to implement this variant of LVT over multiple years, additional research is recommended because our simulation results are short-run estimates of the tax incidence. In the long-run, it is possible (and perhaps likely) that prices would be affected by any shifts in the tax burden. Also, with the relatively small number of residential properties in certain small sections of town, such as the CBD in New London, there are likely to be fewer potential consequences on tax incidence for residential landowners.

To obtain a more complete picture of tax incidence before implementing the SRT or LVT in these special tax business districts, the additional issue of the business district tax rate needs to be considered. This is of particular concern in New Haven, where there are several business districts each with an additional, separate mill rate ranging from $1.25 to $2.50 per thousand dollars. The New London CBD mill rate is $1.17 per thousand dollars. To ensure the revenue neutrality of the SRT, we do not change those separate mill rates in the business districts, but only modify the mill rate of $41.55 per thousand dollars in New Haven and $27.37 per thousand dollars in New London. This has no impact on the revenue neutrality, since if we had included these special tax district mill rates, revenue neutrality would imply they are the same both before and after the split tax implementation.

While there is clear evidence of the potential for vertical equity of a SRT if levied in New London or New Haven, there are still some unanswered questions, some of which may be topics for future research. For instance, can cities with special taxing districts modify their additional special tax rate to raise funds that could be used to even out the burden of a SRT between commercial and residential property owners? Another potential issue is how to discourage or prevent property owners who face a tax bill increase due to the SRT from relocating outside of the special tax district. However, this may not be a serious concern since the SRT should encourage the highest and best use of the land in the district. If residential landowners experience an average property tax bill increase and commercial property owners experience a tax bill decrease on average, this may deter residential development and encourage commercial development in the district. But perhaps residential properties in this district are not the best use of the land. Also, greater demand for commercial property due to a lower tax burden on these properties can lead to additional economic development for these districts. This could give rise to the need for consideration of long-run impacts in future LVT simulation studies.

Finally, our overall findings of vertical equity overall for each city are very robust to whether we examine the incidence of the LVT and SRT through dollar value

tax bill changes, or mean or median percentage change in each quartile. In light of some of the differences in our results relative to findings of past simulation studies for other U.S. cities, we conclude that the property tax incidence of LVT and SRT across property types depends on local conditions. One of our contributions is based on examination of implementing a SRT in one or more of the individual neighborhoods within a city. This leads to a finding that there is heterogeneity across neighborhoods for how moving to a LVT or SRT in that neighborhood would affect changes in its tax burdens for each property class. In many cases, vacant landowners bear the brunt of the burden, but the impacts on owners of developed land is mixed across the various neighborhoods. These horizontal equity findings from moving to LVT or SRT within subsections of New Haven or New London could encourage officials in other cities in Connecticut, in other regions of the U.S., or in other locations worldwide to examine neighborhood-level changes in horizontal equity when considering movement to a graded tax structure.

Endnotes

[1] A literature related to land value taxation has developed with respect to general land use and real estate issues. For example, Anderson (2005) proposes taxation as an approach to regulate land use. Anderson (1999) presents a model of a land value taxation with a nonzero tax rate on improvements (also known as a split-rate tax). Similarly, the issue of horizontal and vertical equity across real estate owners has been considered more generally by others in the real estate literature, including Sunderman, Birch, Cannaday, and Hamilton (1990) and Benson and Schwartz (1997). We build on and synthesize some of the ideas in these two literatures to examine the issue of horizontal equity of a land value tax when considering neighborhoods within a city, as opposed to an entire city as a whole.

[2] See Cohen and Coughlin (2005) for a very accessible and detailed exposition of the theory of LVT and how it can be expected to encourage real estate development without affecting the amount of land.

[3] One challenge in the implementation of LVT is how to obtain separate reliable estimates of land and improvements, and this challenge has been described recently by Hendricks (2005). In subsequent work, Dye and England (2009) and Özdilek (2016) propose some approaches to generate more reliable estimates of land values.

[4] Oates and Schwab (1997), who focus on Pittsburgh, are an exception.

[5] Several recent, short-run LVT simulation studies include England and Zhao (2005), Schwab and Harris (1998), and Bell and Bowman (2008). Nechyba (2001) simulates a general equilibrium model to assess the impacts of LVT. Also, a helpful referee suggested that LVT studies could include a classification of two types of capital, land and improvements, of which the land is immobile and the improvements are mobile. This referee added that such a classification can pose a challenge for implementing general equilibrium models, but favors a simulation approach that generates results comparing descriptive statistics of the data after moving from a uniform tax to a LVT.

[6] A referee suggested that our result of higher tax burdens for properties with higher assessed values is to be expected. This issue is addressed by Cohen and Fedele (2012), who find regressive assessment programs in both New London and New Haven. In the present study, when the split tax is applied and examined in business districts in these cities, the tax is found to be progressive in most instances. Also, there have been other LVT studies, such as England and Zhao (2005), that do not find progressivity, which is contrary to what the reviewer asserts is to be expected. Based on our findings and the findings of other simulation studies, whether the incidence of the split tax will be progressive, regressive, or neutral is specific to a location and its market.

[7] At the outset of writing this paper, we requested assessment data from the City of Bridgeport; however that request was not met.

[8] Having high-quality assessment data is crucial for implementing a SRT or LVT. Given the recent revaluation in New London, this is an indication of the quality of that data. For New Haven, it is likely that another revaluation would be completed in the near future, since most cities in Connecticut revalue every five years. This would further enhance the quality of the New Haven assessment data.

[9] One argument for focusing on short-run simulation models is that most politicians have short-term horizons. Many policy decisions are based on the expected short-run impacts.

[10] Our use of the term "simulate" refers to our changing the mill rates for land and improvements, while doing so in such a manner that keeps total tax revenues constant. We then recalculate the tax bills for each property, and compare the average change in property tax bill for each property class under each set of new mill rates.

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