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EVIDENCE ON THE DISTRIBUTIONAL EFFECTS OF A LAND VALUE TAX ON RESIDENTIAL HOUSEHOLDS

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This study examines how replacing a uniform property tax with a land value tax (LVT) would shift the tax burden for single-family residential properties in Tarrant County, Texas, over the period 1997–2006. Results suggest that a LVT would shift the tax burden away from single-family properties and on to other property classes. For the more recent years in the sample, the average tax liability for single-family properties would decrease about 30 percent, regardless of household income, and Suits Indices suggest that, within residential properties, a LVT would be slightly more progressive than a property tax. Horizontal equity problems would be greatest for the lowest-valued properties relative to other properties. This study also examines how a LVT would change property values due to the effects of tax capitalization.

Keywords: tax burden, horizontal equity, tax capitalization

JEL Codes: H21, H22, H71

I. INTRODUCTION

The LVT is a variation of the property tax. A traditional property tax taxes land and building values at the same rate, while a pure LVT taxes land value but exempts buildings and improvements.[1] Proponents of land value taxation argue that a traditional property tax distorts economic decisions by taxing, and thus penalizing, improvements. A LVT is conjectured to be more efficient because the supply of land is fixed and will not be affected by a tax on land value, assuming that land is valued for tax purposes at its "current highest and best use" (Bell, Bowman, and German, 2009, p. 171). In addition to efficiency gains, the purported benefits of a LVT are that it encourages more intensive land use, reduces urban sprawl, and reduces land speculation (Oates and Schwab, 1997).

[1] As discussed in Bourassa (2009), a less extreme version of a LVT is a split-rate tax, which taxes land and improvements, but at different rates. The land tax rate is usually the greater of the two. This is also referred to as a two-tier or graded property tax.

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Regardless of a LVT's efficiency and economic development advantages, public and legislative support for a LVT depends a great deal on how the tax would affect the distribution of the tax burden. Would a LVT be more or less progressive than a traditional property tax? Who are the winners and losers? There are few studies that examine the distributional effects of a LVT, although increased interest in land value taxation has motivated two recent studies. England and Zhao (2005) examine the distributional consequences of changing from a uniform property tax to a LVT for Dover, NH. They find that a LVT would increase the tax on single-family residential property and that changes within this property class would be regressive. In contrast, Bowman and Bell (2008) provide a similar analysis for Roanoke, VA, and find the opposite result. They find that changing to a pure LVT would *reduce* the aggregate tax burden of residential properties and would be more progressive than the traditional property tax.

This study examines how replacing a uniform property tax with a LVT would affect the tax burden of owner-occupied, single-family residential properties in Tarrant County, TX, over the 10-year period 1997–2006. Owner-occupied, single-family residential properties make up the largest property class in Tarrant County, representing a little over 50 percent of the total market value of all real properties in the county.[2] During this time period, the number of owner-occupied, single-family properties increased from 249,731 to 330,835, and the total market value grew from $21.4 to $49.1 billion. I focus on owner-occupied, single-family residential properties for two reasons. First, I assume in the analysis that economic and statutory incidence are identical. Of course, in many cases, a tax burden can be shifted from one taxpayer to another so that the tax's statutory incidence differs from its economic incidence. For example, owners of rental property could shift the tax to renters (higher rental payments), while owners of business property could shift the tax to consumers (higher retail prices). However, focusing on owner-occupied, single-family residential properties increases the probability that the property owner bears the tax's economic incidence, since opportunities for tax shifting are relatively limited. Second, in much of my analysis, I assume that property value proxies for household lifetime income. While this may be a reasonable assumption for owner-occupied residential properties, it is less likely to be a reasonable assumption for rental properties.[3]

This study's results are summarized as follows. On an aggregate basis, a revenue-neutral LVT would shift the tax burden *away* from single-family residential properties and on to other property classes. Over the 10-year period, a LVT would decrease taxes for 85.5 percent of residential homeowners, and the median average change in tax liability

[2] If rental houses and second homes are included, single-family residential property represents about 65 percent of the total market value of all real properties in Tarrant County.

[3] Lifetime income measures are preferable to annual income measures because lifetime measures are less subject to temporary fluctuations (Metcalf, 1994), and because individuals are likely to make consumption decisions based on lifetime income and not annual income (Fullerton and Metcalf, 2002). Consistent with prior research (Poterba, 1989, 1991; CBO, 1990; Metcalf, 1994), I use consumption as a proxy for lifetime income, and use residential property value to measure consumption.

would be –28.6 percent. To provide evidence on the distributional effects of a LVT across households with different income levels, I rank all single-family properties from high value to low value and divide them into three groups — top 30 percent, middle 40 percent, and bottom 30 percent. Evidence suggests that a LVT would decrease the average tax liability for all three groups. Although the change in tax liability would be largest in dollar terms for the highest-value properties, the percentage change in tax liability is comparable across groups — at least in the years from 2003–2006. I also compute a Suits index for each year to measure the LVT system's overall progressivity. Results suggest that that a revenue-neutral LVT would be slightly more progressive than the property tax for the years subsequent to 2000.

I also examine the effects of a LVT on horizontal equity, defined in this case as the variation in effective tax rates across property owners with similar property values. The evidence suggests that the variation in effective tax rates would be greatest for the lowest-valued properties (properties valued at less than $40,000), implying that horizontal equity would be lower for this group compared with other properties. I also examine how changes in tax liability resulting from a LVT are related to annual income measures from the 2000 U.S. Census. Results are consistent with those which use property value to measure household income. The average decrease in tax liability (in dollar terms) will be greatest for taxpayers in high-income census tracts, but the percentage changes in tax liability are comparable across income levels.

Last, I examine how changing from a property tax to a LVT will affect property values. If a LVT changes a property's expected future tax liabilities, then the property's market value will change — an effect referred to as tax capitalization. Capitalization effects will also depend on how soon land values are reassessed after a LVT system is implemented. I therefore examine two scenarios — one with no reassessment of land values and one with immediate reassessment of land values. These two cases represent the boundaries on the range of outcomes. Results suggest that, if land values are not reassessed when a LVT is implemented, single-family residential property values would increase a median average of 5–12 percent. If land values are reassessed as part of the LVT system's implementation, then the median increase in property value would be about 19-25 percent. If land values are reassessed but with some delay after a LVT is implemented, the median change in property values would fall somewhere within the range of these two cases.

This study makes several contributions to the study of land value taxation. First, it examines how changing to a LVT system would affect property values through the effects of tax capitalization. Changes in property values will shift wealth among current property owners, resulting in distributional effects that have been ignored in prior studies, including the two studies cited above. Considering these capitalization effects provides a much more complete analysis of how a LVT system would affect the tax burden than does an analysis of single-year tax burden changes.

Second, this study provides detailed empirical evidence on the vertical and horizontal equity effects of a LVT. Most empirical studies focus on the LVT's economic efficiencies (e.g., reduction in deadweight losses) or its effects on economic development (e.g., reduction in urban sprawl). There are few studies that provide detailed evidence on how a LVT would affect vertical equity, and no studies of which I am aware that provide evidence on how a LVT would affect horizontal equity.[4] The lack of evidence seems especially problematic, given that the "public cares deeply about equity and less about efficiency" (Schwartz, 1998, p. 260). Understanding the LVT's equity effects is essential if the LVT is ever to be considered a serious alternative, or supplement, to the traditional property tax. Academicians, policymakers, and taxpayers need empirical evidence on the LVT's distributional effects to help facilitate informed policy decisions.[5]

Third, this study contributes to the evidence on the effects of a LVT by examining a large number of residential properties in north central Texas over an extended period of time (i.e., an average of 288,000 north central Texas properties over a 10-year period). This increases our understanding of the generalizability of results on a LVT's distributional effects over time, and across different geographic areas and jurisdiction types. Finally, although this study focuses on a lifetime measure of income, it also tests the sensitivity of the results to this approach by following Bowman and Bell (2008) and investigating the effects of using an annual measure of current household income.

The remainder of this paper is organized as follows. The next section reviews prior research that examines the distributional effects of a LVT. Section III describes the data and sample, including descriptive statistics, and Section IV presents results examining how a LVT would affect vertical and horizontal equity for owner-occupied, single-family residential properties in Tarrant County. Section V presents results that use census tract income data to examine how a LVT would affect vertical equity. Section VI provides an analysis of tax capitalization effects, and the final section presents conclusions.

II. PRIOR RESEARCH

Increased interest in land value taxation has motivated researchers to examine the differential tax incidence of a LVT compared with a traditional property tax. In general, these studies focus on a specific geographic area (e.g., a single city) and estimate the tax burden of a hypothetical LVT that would generate the same amount of tax revenue as the current property tax. The hypothetical distribution is compared with the actual property tax distribution to determine how a LVT would redistribute the tax burden across property owners, identifying changes in tax liability across taxpayer groups.

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[4] Bibliographies provided by Grote (2007) and Dye and England (2009) show that there are a relatively small number of studies that focus on the LVT's equity implications. These studies are discussed in Plummer (2009). The only study to address horizontal equity is Sjoquist (2007). However, he does not compare the horizontal equity of a LVT with that of a uniform property tax. He examines Jamaica's LVT system, and shows how its current structure (with tax caps) decreases horizontal equity when compared with a LVT without tax caps.

[5] For example, in 2001 and again in 2003, tax bills were introduced in both houses of the Minnesota state legislature. Both bills included provisions for a transition to a state-wide LVT, and in both cases, the LVT provisions were eventually dropped. Major reasons included uncertainties about the ultimate burden of a LVT and a lack of familiarity among legislators regarding land value taxation (Haveman, 2004).

The studies most relevant to this analysis are England and Zhao (2005) and Bowman and Bell (2008). England and Zhao (2005) use tax parcel data for Dover, NH, to provide evidence on how a split-rate tax would redistribute the tax burden across property owners. Dover is a small but growing city north of metropolitan Boston. England and Zhao's sample consists of 5,250 single-family residential properties for 2002. They find that, as a whole, single-family residential properties in Dover would bear a larger percentage of the total property tax under a split-rate tax system than under the existing uniform tax rate system. The authors use assessed property value to measure household income and find that the tax changes across residential homeowners would be regressive unless some type of tax relief were also implemented.

Bowman and Bell (2008) use residential property data for the city of Roanoke, Virginia, to examine the distributive effects of changing from a traditional property tax to a pure LVT. Their sample consists of 28,680 single-family residential properties for 2003. They perform a similar analysis as England and Zhao (2005), but with very different results. Bowman and Bell find that changing to a pure LVT would *reduce* the aggregate tax burden of residential properties. The authors then examine the distributional effects across households using different measures of household income. The first measure of household income is assessed property value, which is the same income measure used by England and Zhao. Bowman and Bell also link the Roanoke property tax data to income data from the U.S. Census Bureau, and use several census tract income measures to measure household income (e.g., median family income). Regardless of the income measure used, the authors find that a LVT would benefit most those areas with the lowest incomes and the highest poverty rates. In contrast to England and Zhao, Bowman and Bell's results suggest that a LVT would be *more* progressive than the traditional property tax.[6]

In reconciling their results with those of England and Zhao, Bowman and Bell (2008) suggest that the different results reflect between-city differences in land value ratios (i.e., the ratio of land value to total property value). The authors suggest that these differences arise because Roanoke has characteristics of older central cities — cities that have experienced some population loss but remain an employment center — whereas Dover is more like a growing bedroom community north of Boston. This results in residential properties in Roanoke having a much lower land value ratio than residential properties in Dover. On average, land value constitutes 14.3 percent of a single-family's total property value in Roanoke and 34.7 percent in Dover.[7] In addition, there is more

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[6] Bowman and Bell (2004) explore the distributional implications of changing from a traditional property tax to a pure LVT for two additional Virginia local governments: the counties of Chesterfield (metropolitan, with over 250,000 residents) and Highland (rural, with fewer than 2,500 residents). For both counties, they find that moving from a traditional property tax to a LVT would decrease the share of taxes paid by residential property owners and increase the share paid by business property owners.

[7] Bowman and Bell (2008), Table 3, reports the average ratio of building value divided by assessed land value for single-family homes. The average ratio for Dover is 1.88, and the average ratio for Roanoke is 5.99. These values imply average land value ratios (land value divided by total property value) of 0.347 and 0.143, respectively.

variation in the land value ratios for single-family residential properties in Roanoke than in Dover.[8] [9]

III. DATA AND SAMPLE

A. Tarrant Appraisal District Data

Tarrant County is an urban county located in north central Texas that covers approximately 898 square miles and currently has about 1.7 million residents. Most of those residents live in Fort Worth, the county's largest city. Tarrant County's population grew by 24 percent over the period 1990–2000; it was ranked as the fifth fastest growing county in the United States for the 12-month period beginning July 2007.

Data for this study come from the Tarrant Appraisal District (TAD) database for the years 1997–2006, and from the 2000 U.S. Census. The TAD data contains parcel-level information for all real properties in TAD, including the values of residential, business, agricultural, and vacant land. TAD is responsible for appraising all properties in Tarrant County, and TAD's boundaries are approximately the same as those of Tarrant County.

Real property market values are generally unobservable, unless a property is sold during the year. This study therefore uses appraisal value to proxy for unobservable market value. Although not a perfect proxy, there are several reasons why TAD's land values are likely to be reasonable estimates of market values — especially for residential properties.[10] First, Texas law requires that real property be appraised at 100 percent of market value and that appraisal records report separate market values for land and improvements. In addition, TAD has adopted an annual reappraisal cycle. This means

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[8] Plummer (2009) discusses other studies that examine the distributional effects of a LVT. These studies include Schwab and Harris (1997) for Washington, DC; Haveman (2004) for commercial and industrial property in Minnesota; Gloudemans (2000) for Canada; De Cesare, et al. (2003) for Brazil; and Sjoquist (2007) for Jamaica.

[9] All studies that examine the distributional effects of a LVT generally make two assumptions. First, calculations of differential tax incidence are generally based on the assumption that there is no change in land values after a LVT is implemented. However, if a LVT changes a property's expected future tax liabilities, this may cause the property's market value to change — an effect referred to as "tax capitalization." I examine the effects of tax capitalization on property values in Section VI. Second, studies generally focus on how a LVT would affect statutory (legal) tax incidence. They generally do not estimate how taxes might be shifted to other groups in the long-run (e.g., a business tax being shifted to consumers in the form of higher retail prices). Because of these assumptions, these distributions studies do not provide long-term analysis, which would incorporate possible market responses such as changes in land values and tax shifting. Although a long-term analysis could provide valuable information about a LVT's ultimate economic incidence, there are several advantages to examining a LVT's short-term effects on legal tax incidence. First, short-term analysis requires far fewer assumptions and estimations, making the results more interpretable and reliable than results from a long-term analysis. Second, a short-term analysis is the first step toward a more complete, long-term analysis of a LVT's distributive effects. Third, a short-term analysis provides information on how a LVT would initially shift the tax distribution across property owners. These initial changes in actual tax payments are likely to be a dominant factor in influencing voter attitudes about adopting a LVT.

[10] The following information is taken from the 2006 TAD Reappraisal Plan, and was confirmed in discussions with TAD officials.

that a property's appraised market value, including its specific land and improvement components, are reviewed and adjusted each year. If TAD continued to reappraise land values annually after a LVT system was implemented, it is less likely that any capitalization effects would be delayed long.

TAD's Residential Appraisal Department is responsible for appraising single-family residential property. TAD's primary approach to valuing residential properties is the market or sales comparison approach. TAD uses recent sales within a neighborhood to determine the appropriate market adjustment for the neighborhood. This generally involves comparing the recent sales prices of neighborhood properties to their appraised values to determine the appropriateness of the sold properties' appraised values (i.e., sales ratio analysis).[11]

Evidence indicates that TAD's assessed market values for single-family residential properties are of good quality by industry standards. The *Texas Property Tax Code* requires the State Comptroller to conduct an annual *Property Value Study*, which measures appraisal performance for all appraisal districts in Texas. For TAD's single-family residential properties for the years 1999–2006, the average median appraisal ratio is 0.98 (i.e., 98 percent of market value), the average coefficient of dispersion (COD) is 4.79, and the average price-related differential (PRD) is 1.00. COD and PRD are measures of appraisal uniformity. COD is a measure of horizontal equity and measures whether appraisal districts are appraising properties at an equal percentage of market value. A smaller COD value suggests greater uniformity, with COD=0 showing perfect uniformity. PRD is a measure of vertical equity, and is used to indicate whether assessment ratios of high-value and low-value properties are systematically different. The appraisal ratio and the COD and PRD values suggest that the TAD results are well within the International Association of Assessing Officers (IAAO, 2007) guidelines.[12]

Evidence also suggests that the TAD appraisers are careful in estimating the separate market values for the land and building components of real property. Each year, TAD's Residential Appraisal Department conducts residential land analysis to develop land-specific values for single-family residential properties. The appraisers use sales data where available, or abstraction and allocation methods, to help ensure that the land values best reflect the land's contribution to overall property value.[13] TAD makes extensive use of geographic information system (GIS) technol-

[11] TAD maintains a file that contains sales data for vacant and improved residential real properties. This information is collected from a variety of comprehensive sources, including data from the Board of Realtors and other sales vendors, builders, brokers, district survey letters sent to buyers and sellers, field discovery, and protest hearings. In 2005 and 2006, the numbers of sales received and processed by the residential research staff were 24,756 and 25,856, respectively.

[12] In its *Standard on Ratio Studies* (2007), the International Association of Assessing Officers (IAAO) suggests that acceptable standards are a median appraisal ratio between 0.90–1.10, a COD value of between 5.0–10.0 for single-family residential properties, and a PRD of between 0.98–1.03.

[13] As discussed in Bell, Bowman, and German (2009), the abstraction method starts with the property's total market value and subtracts the depreciated cost of replacing improvements. The residual value is attributed to land. The allocation method allocates a percentage of the total property value to land, where the percentage is determined using market evidence.

ogy and thus has access to information about numerous land characteristics, including location, shape, size, view, and topography.

In sum, the evidence suggests that TAD's current appraised land values are reasonable estimates of the appraised land values that would occur under a LVT system. This is likely to be especially true in the early years of a LVT, as appraisal districts would be transitioning from their current property tax systems with their existing land values. However, measurement error of land value remains a concern under a LVT system (Bell, Bowman, and German, 2009). Measurement error not only affects estimates of tax shifting, but would also affect *actual* tax shifting under a LVT system if land values were not reassessed appropriately when a LVT system is implemented. In the analysis below, I discuss the effects that measurement error would have on shifts in the tax burden.

B. Descriptive Statistics

Table 1 presents descriptive information on owner-occupied, single-family residential properties in Tarrant County over the period 1997–2006. The number of properties grew by 32.5 percent over the 10-year period, while total market value grew by

Table 1

Descriptive Information for Owner-Occupied, Single-Family Residential Properties in Tarrant County ($ Millions)

Year	Number of Properties	Total Market Value ($)	Total Land Value ($)	Total Improvement Value ($)	Land Value Ratio[1] Mean	Land Value Ratio[1] Median
1997	249,731	21,358	4,701	16,656	0.2248	0.2047
1998	250,210	22,560	4,811	17,749	0.2175	0.1983
1999	257,690	24,568	5,077	19,491	0.2116	0.1916
2000	273,377	28,075	5,485	22,589	0.1992	0.1806
2001	282,180	31,715	5,829	25,886	0.1848	0.1683
2002	296,394	37,276	6,294	30,983	0.1679	0.1538
2003	301,087	40,018	6,581	33,436	0.1626	0.1497
2004	310,062	42,712	6,997	35,715	0.1617	0.1489
2005	326,401	46,579	7,755	38,824	0.1629	0.1496
2006	330,835	49,082	8,254	40,828	0.1660	0.1515
10-year growth	32.5%	129.8%	75.6%	145.1%	(26.2%)	(26.0%)

Notes: The 10-year growth in the Consumer Price Index (CPI) for the Dallas-Fort Worth area is 25.6 percent. (1) "Land value ratio" is defined as the proportion of a property's total market value attributable to land value and is equal to the market value of land, divided by the market value of land plus improvements. The mean and median values are computed using parcel-level property data.

129.8 percent — from \$21.4 billion to \$49.1 billion.[14] The growth in residential property values greatly exceeded the 10-year growth in the Consumer Price Index (CPI) for the Dallas-Fort Worth area, which was only 25.6 percent. Table 1 also shows that land values grew more slowly than improvement values, with 10-year growth rates of 75.6 percent and 145 percent, respectively. Accordingly, land represents a lower percentage of total market value in 2006 than in earlier years. The difference in growth rates between land and improvement values is due in part to new residential properties — some quite large — being built on less expensive land located in suburban and more rural areas of the county.

The last two columns of Table 1 are computed using parcel-level property data and present mean and median for the land value ratios. "Land value ratio" is defined as the proportion of a property's total market value attributable to land value and is equal to the market value of land divided by the market value of land plus improvements. The average land value ratio for owner-occupied, single-family residential properties has decreased over the past 10 years. Between 1997–2006, the mean land value ratio declined from 22.5 percent to 16.6 percent, while the median ratio declined from 20.5 percent to 15.2 percent. The more recent land value ratios are similar to the 14.3 percent average for Roanoke, Virginia, and smaller than the 34.7 percent average for Dover (Bowman and Bell, 2008; England and Zhao, 2005).

IV. RESULTS

A. Effect of a LVT on the Tax Burden of Owner-Occupied Single-Family Residential Properties

This study assumes that the current uniform property tax would be replaced by a revenue-neutral LVT, which requires calculation of the tax rate on land values that would generate revenues equal to a jurisdiction's property tax revenues. Over the period 1997–2006, the actual property tax rate averaged 2.42 percent — ranging from a low of 2.36 percent in 1998 to a high of 2.50 percent in 2004. For this same 10-year period, the revenue-neutral LVT rate would average 10.31 percent — ranging from a low of 8.94 percent in 1997 to a high of 11.40 percent in 2005.[15]

I first investigate how changing from a property tax to a revenue-neutral LVT would affect the average tax burden of all owner-occupied, single-family residential proper-

[14] I use TAD assessed market values to proxy for market values, but for ease of exposition, I refer to all values simply as market values.

[15] Consistent with England and Zhao (2005) and Bowman and Bell (2008), this study uses existing land values to calculate the revenue-neutral tax rate (t_L) and also uses a static definition of "revenue neutrality." Over the long-run, shifting to a LVT would have capitalization, reassessment, and construction effects. As these effects occur, the two revenue trajectories (property tax versus LVT) would diverge. Furthermore, if shifting to a LVT system changes land values, and if land values are reassessed to reflect these changes, then the revenue-neutral tax rate based on existing land values may differ from the rate based on post-LVT land values. Estimating a tax rate based on post-LVT land values requires one to estimate land values for all properties in the taxing jurisdiction (residential and business), which are in turn a function of t_L. Such a simultaneous analysis is left for future research.

ties (hereafter, “residential properties”). For each residential property, I calculate the tax liability under the current property tax and the revenue-neutral LVT. The change in a property’s tax liability is equal to the property’s LVT liability minus its property tax liability. Table 2 presents the results for the years 1997–2006. The first four columns show the average (mean and median) dollar amounts paid each year under the current property tax system and a revenue-neutral LVT system. The next two columns show average values for the change in tax liability, while the next two columns show average values for the percentage change in tax liability (i.e., change in tax liability divided by property tax liability).

Table 2 shows that changing to a LVT would decrease the average tax liability for residential properties for each year 1997–2006. In 2006, for example, the mean property tax liability is $3,536, while the mean LVT liability is $2,708 — an $828 lower tax liability. The “percentage change in tax liability” values are useful because they help control for changes in the dollar’s value over time. Table 2 shows that the average percentage change in tax liability has become more negative over the 10-year period. This increasingly negative percentage change in tax liability is due to the decreasing land value ratios for residential properties as shown in Table 1.[16] Across all years, Table 2 shows that a LVT would decrease a residential property owner’s tax liability by a mean of 21.8 percent and a median of 28.6 percent. These values are similar in magnitude to those reported in Bowman and Bell (2008). For their sample of single-family residences in Roanoke, VA, the mean and median percentage change in tax liability for 2003 would be –20.7 percent and –24.2 percent (see their Table 4).

Of course, not all single-family residential property owners would experience a tax decrease if a LVT replaced the property tax. The last column of Table 2 shows the percentage of property owners that would experience a tax *increase* if a LVT were implemented. This percentage is generally decreasing over time, and only 12.7 percent of property owners would face a higher tax burden in 2006 if a LVT were implemented. Over the 10-year period, a LVT would *decrease* taxes for 85.5 percent of residential homeowners. These results are quite similar to Bowman and Bell (2008), who report that a LVT would decrease the 2003 tax liability for 84.8 percent of their single-family properties (see their Table 4).[17]

[16] The mean and median land value ratios for all other property classes, except the multi-family residential property class, remain stable across time. The ratios for multi-family properties decrease over time.

[17] The change in tax burden for single-family residential properties also depends on the quality of land values for other property classes (e.g., business properties). If the ratio of assessed-to-market land value for other property classes is lower (higher) than the ratio of assessed-to-market land value for single-family residential properties, then the estimated LVT burden for single-family residential properties as a whole will be too high (too low). Evidence suggests that the land values for other property classes are reasonable estimates of their land values. TAD’s Commercial Appraisal Department reviews values annually, compares assessed land values with recent commercial land sales in each designated land market area, and extensively codes a property’s land characteristics. Objective measures for the quality of TAD’s assessed market values for other property classes are well within the IAAO guidelines (i.e., average values of 0.99 for median appraisal ratio, 6.67 for COD, and 1.02 for PRD).

Table 2
Differential Tax Incidence: Effect on Tax Liability of Changing from a Property Tax to LVT System, Owner-Occupied Single-Family Residential Properties

	Property Tax Liability ($)		LVT Liability ($)		Change in Tax Liability ($)		Percentage Change in Tax Liability		Percent of Properties with Increase in Tax Liability
Year	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
1997 (n=249,731)	2,033	1,676	1,683	1,341	(350)	(348)	(15.4)	(23.0)	20.5
1998 (n=250,210)	2,123	1,757	1,738	1,401	(385)	(381)	(16.5)	(23.9)	19.0
1999 (n=257,690)	2,264	1,859	1,831	1,487	(432)	(424)	(17.1)	(25.0)	18.5
2000 (n=273,377)	2,509	2,067	2,001	1,596	(508)	(499)	(18.7)	(26.3)	16.4
2001 (n=282,180)	2,705	2,214	2,095	1,622	(610)	(600)	(22.2)	(29.1)	13.9
2002 (n=296,394)	3,080	2,537	2,307	1,792	(773)	(758)	(25.5)	(31.8)	11.2
2003 (n=301,087)	3,272	2,730	2,451	1,906	(821)	(815)	(25.9)	(31.8)	10.8
2004 (n=310,062)	3,441	2,877	2,560	1,940	(880)	(876)	(26.6)	(32.3)	10.6
2005 (n=326,401)	3,563	2,961	2,709	2,052	(854)	(875)	(25.6)	(31.7)	11.3
2006 (n=330,835)	3,536	2,920	2,708	1,954	(828)	(841)	(24.4)	(31.0)	12.7
Average	2,853	2,360	2,208	1,709	(644)	(642)	(21.8)	(28.6)	14.5

B. Effects of a LVT on the Distribution of the Tax Burden

To provide evidence on the distributional effects of changing from a property tax to a LVT, England and Zhao (2005) and Bowman and Bell (2008) rank all single-family properties from high value to low value, and then divide them into three groups — top 30 percent, middle 40 percent, and bottom 30 percent. For each group, they report statistics on the average change in tax liability and on the percentage of property owners that would face a tax increase if a LVT were implemented. I perform a similar analysis for my sample for each of the years 1997–2006 and present results in Table 3. For each of the three property wealth groups, Table 3 provides the mean and median change in tax liability, mean and median percentage change in tax liability, and the percentage of properties that would experience a tax increase under a LVT system. For ease of exposition, I graphically depict some of the information in Figures 1, 2, and 3 below. I focus my discussion on the figures and refer to additional details provided in the table.

Figure 1 shows the median change in tax liability, in dollars, for each property wealth group. The average tax liability for each group would decrease if a LVT were implemented, and this decrease becomes more negative over time. The average decrease would be largest for the high-value properties and smallest for the low-value properties. The median reduction in tax liability ranges from $101–488 for the lowest-valued properties, $370–933 for the middle group, and $883–1,623 for the highest-value properties. The relative pattern is similar if mean averages are compared across groups and over time, although the decreases are slightly smaller in absolute value terms (Table 3).

Figure 2 below shows the median percentage change in tax liability for each property wealth group. For the years 1997–2002, the highest-valued 30 percent of properties would experience the largest median percentage decrease (ranging from 28.8–33.3 percent), while the lowest-valued 30 percent of properties would experience the smallest percentage decrease (ranging from 13.9–29.0 percent). The median percentage decrease for the middle group ranges from 21.6–31.9 percent. In the years from 2003–2006, however, the median percentage reduction in tax liability is comparable across groups — ranging from 29.7–32.7 percent in all cases.

The post-2002 results of this study suggest similar percentage changes across all three wealth groups. This differs from Bowman and Bell (2008), who find that the median percentage change in tax liability becomes more negative as property value decreases. For their 2003 sample, the median percentage change in tax liability would be –21.9 percent for the highest-valued properties, –23.1 percent for the middle group, and –29.4 percent for the lowest-valued properties (see their Table 4). Bowman and Bell's results suggest that a LVT would increase progressivity more for Roanoke than it would for Tarrant County.

Figure 3 below shows the percentage of property owners in each group that would experience a tax *increase* if a LVT were implemented. For all years, owners of the lowest-valued properties would be the most likely to face a tax increase. However, the percentage of this group facing an increase drops significantly over this period. In 1997, almost 36 percent of property owners in the lowest-value group would experience a

Table 3

Differential Tax Incidence: Change in Tax Liability by Property Wealth Group

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Top 30 percent										
Median ΔTL ($)	(883)	(929)	(1,035)	(1,147)	(1,297)	(1,505)	(1,551)	(1,623)	(1,612)	(1,597)
Median %ΔTL	–28.8	–28.9	–30.0	–30.2	–32.2	–33.3	–32.6	–32.7	–31.4	–31.6
Mean ΔTL ($)	(704)	(752)	(846)	(949)	(1,098)	(1,304)	(1,334)	(1,400)	(1,304)	(1,304)
Mean %ΔTL	–20.3	–20.9	–21.8	–22.1	–23.9	–25.3	–24.8	–24.9	–22.5	–22.5
% with tax increase	13.3	13.1	12.6	12.6	12.2	11.7	11.8	11.8	13.2	13.4
Middle 40 percent										
Median ΔTL ($)	(370)	(409)	(460)	(543)	(645)	(807)	(834)	(929)	(933)	(897)
Median %ΔTL	–21.6	–22.9	–24.5	–26.1	–29.0	–31.9	–31.7	–32.3	–31.7	–31.1
Mean ΔTL ($)	(297)	(336)	(381)	($463)	(551)	(715)	(770)	(839)	(827)	(794)
Mean %ΔTL	–17.1	–18.7	–19.9	–22.0	–24.3	–27.7	–27.8	–28.9	–27.7	–27.0
% with tax increase	14.6	12.5	11.5	9.5	8.3	6.5	6.5	6.0	7.3	8.1
Bottom 30 percent										
Median ΔTL ($)	(101)	(119)	(124)	(169)	(242)	(362)	(420)	(457)	(488)	(457)
Median %ΔTL	–13.9	–15.7	–15.7	–19.2	–24.2	–29.0	–31.0	–31.8	–31.9	–29.7
Mean ΔTL ($)	(66)	(83)	(86)	(127)	(203)	(320)	(376)	(415)	(442)	(397)
Mean %ΔTL	–8.3	–9.1	–8.8	–10.9	–17.5	–22.8	–24.5	–25.2	–25.8	–22.7
% with tax increase	35.6	33.4	33.9	29.4	23.1	17.0	15.5	15.4	14.7	17.9
Total sample size	249,731	250,210	257,690	273,377	282,180	296,394	301,087	310,062	326,401	330,835

Notes: *ΔTL* = Change in tax liability in dollars, *%ΔTL* = Percentage change in tax liability, and *% with tax increase* = percentage of properties with a tax increase under a LVT.

Figure 1

Median Change in Tax Liability, by Group:
Owner-Occupied Single-Family Residential Properties

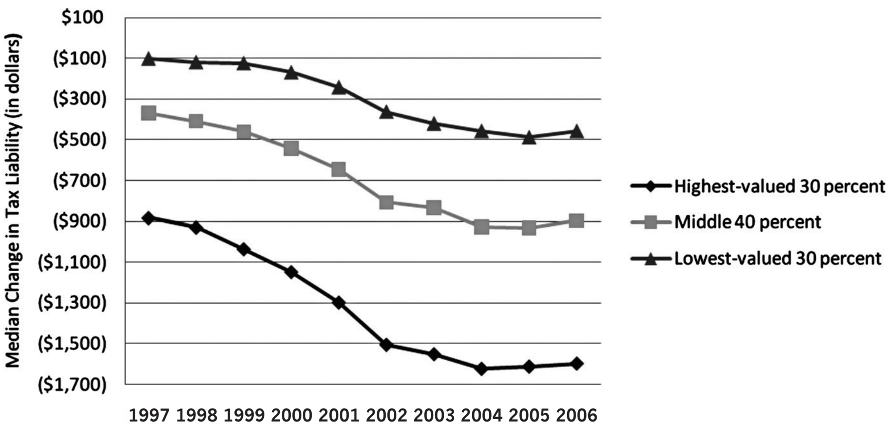
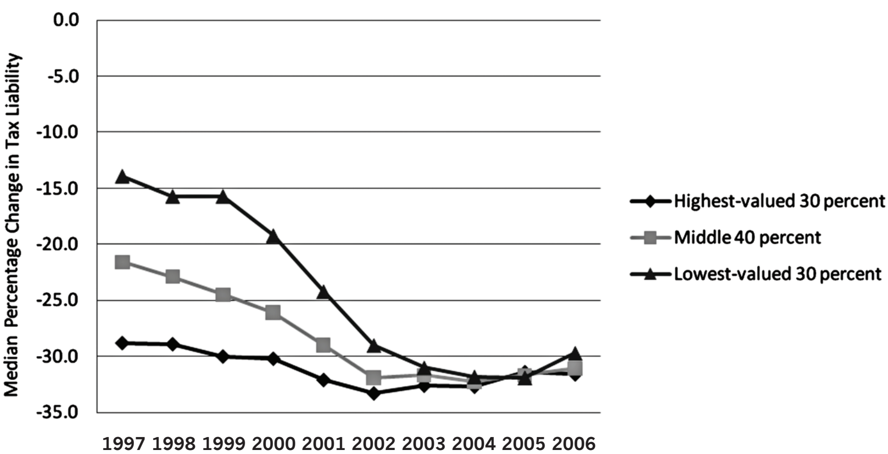


Figure 2

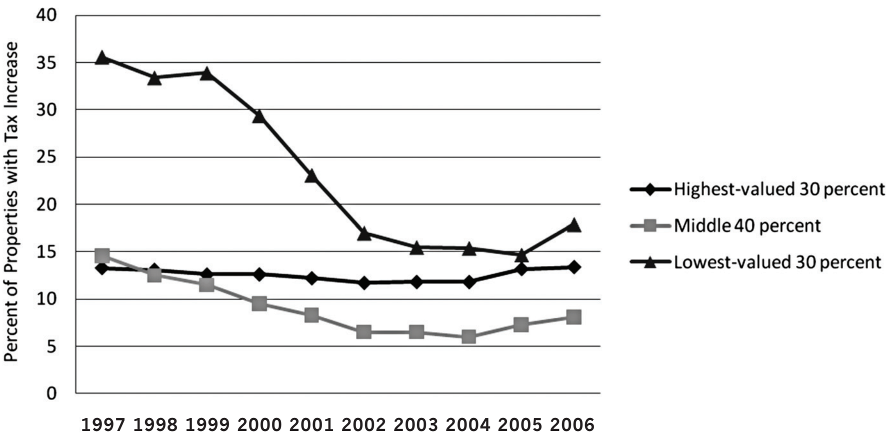
Median Percentage Change in Tax Liability, by Group:
Owner-Occupied Single-Family Residential Properties



tax increase under a LVT, but the percentage drops to 17 percent in 2002 and remains there (or slightly lower) in all subsequent years. For the highest-valued properties, there is little change across time in the percentage of owners who would experience a tax increase. For all years, about 12–13 percent would pay higher taxes under a LVT. Owners of the middle 40 percent of properties are the least likely to face a tax increase

Figure 3

Percentage of Properties with Tax Increase, by Group:
Owner-Occupied Single-Family Residential Properties



if a LVT were implemented. In all years except 1997, the percentage of property owners who would pay higher taxes under a LVT is the smallest for this group, and in each year subsequent to 1999, fewer than 10 percent of these property owners would face a tax increase.

This study's 2002–2006 results for the low and middle groups are similar to those of Bowman and Bell (2008), who find that a LVT would increase the 2003 property taxes for 17.8 percent of the lowest-value properties and 8.2 percent of the middle properties. Bowman and Bell's high-valued properties are slightly more likely to experience a tax increase under a LVT than this study's high-valued properties (21.9 percent versus 12–13 percent). In contrast, this study's results differ significantly from England and Zhao (2005), who find that a pure LVT would increase property taxes for 99.2 percent of their sample's lowest-valued properties, 80.3 percent of the middle properties, and only 26.1 percent of the highest-valued properties (see their Table 7).[18] The different patterns across studies reflect differences in land value ratio patterns. For Dover, land value ratios appear to increase as property values decrease, making a tax increase more likely for lower-valued properties. For Roanoke and Tarrant County, average land value

[18] Measurement error in land values *within* the residential property class should not affect the relative distributional analysis unless the ratio of assessed-to-market land value varies systematically with property value. If the ratio of assessed-to-market land value is lower for high-value properties than for low-value properties, then the estimated LVT burden for high-value properties is too low. The analysis will understate the LVT's progressivity, compared with the case where land values were assessed correctly. Conversely, if the ratio of assessed-to-market land value is higher for high-value properties, then the estimated LVT burden for high-value properties is too high and the analysis will overstate the LVT's progressivity. Measurement error in land values *across* different property classes is discussed in the footnote above.

ratios are smallest for the middle-valued property group, making these properties the least likely to experience a tax increase under a LVT.

C. Suits Indices for a LVT System

The data presented above provide evidence on how a LVT would change the tax burden across income groups as well as direct comparisons with the findings of England and Zhao (2005) and Bowman and Bell (2008). However, the analysis does not provide a summary measure of the LVT system's overall vertical equity. Researchers examining property tax incidence often use the Suits index to measure a tax system's overall progressivity (Suits, 1977).[19] The Suits index can vary from –1 to +1, with –1 indicating maximum regressivity and +1 indicating maximum progressivity. An index value of 0 indicates a proportional tax. I compute a Suits index for the LVT system separately for each year and report results in Table 4. The index is slightly negative (S = –0.0125) in 1997, and then steadily increases to 0.0226 in 2006. The trend of values suggests that the LVT becomes slightly more progressive over the 10-year period. However, all index values are very close to zero, with values ranging from –0.0125 to 0.0295. Because I use property value to measure household income, the Suits index for the property tax

Table 4

Suits Indices for a LVT System:
Owner-Occupied, Single-Family Residential Properties

Year	Number of Properties	Suits Index
1997	249,731	–0.0125
1998	250,210	–0.0090
1999	257,690	–0.0099
2000	273,377	–0.0035
2001	282,180	0.0031
2002	296,394	0.0143
2003	301,087	0.0188
2004	310,062	0.0224
2005	326,401	0.0295
2006	330,835	0.0226

[19] The Suits index = $1-[\Sigma_{k=1}^{10}(1/2)(PT_k + PT_{k-1})(Y_k-Y_{k-1})]/5{,}000$ where PT_k=cumulative percent of property tax burden for population deciles 1 through k, and Y_k=cumulative percent of total income for population deciles 1 through k.

system — without exemptions — is zero (i.e., a perfectly proportional tax).[20] Therefore, the Suits index values in Table 4 suggest that the LVT would be slightly more progressive than the property tax in years subsequent to 2000.

D. Effects of a LVT on Horizontal Equity

Horizontal equity requires that taxpayers with equal before-tax incomes should have the same effective tax rates (Gravelle and Gravelle, 2006). However, under a LVT, property owners with identical total property values will owe different tax liabilities if their land values differ. To examine the effects of a LVT system on horizontal equity, I compare the variation in the LVT effective tax rates across property owners of equal incomes. For each of the 10 years separately, I divide taxpayers into 51 groups based on their similarity in property value (a proxy for income), and all members of a group are considered to have equivalent income.[21] I compute the effective tax rate for each property, defined as the property's tax liability under the LVT system divided by the property's total market value. I then compute the coefficient of variation (CV) for the effective tax rates separately for each of the 51 groups of income-equivalent property owners.[22] Accordingly, there are 51 coefficients of variation computed for each of the 10 years.

I analyzed horizontal equity separately for each year, but for parsimony, only present results for 2006. Figure 4 plots the CV value for each group for 2006.[23] Higher CV values indicate greater variation in effective tax rates for the group, and thus less horizontal equity. Figure 4 shows that the lowest-valued properties (i.e., those groups with properties valued at less than $40,000) have the greatest variation in effective tax rates. The CV values are 91, 88, and 74. The CV values for all other groups are 58 or less. Groups with properties valued between $80,000–160,000 have the lowest CV val-

[20] Perfect proportionality results because taxpayers are being taxed at a uniform rate on the full market value of their property, which is also the measure of their income. The property tax would not be perfectly proportional if exemptions were allowed to reduce a property's taxable value below its market value (Plummer, 2003).

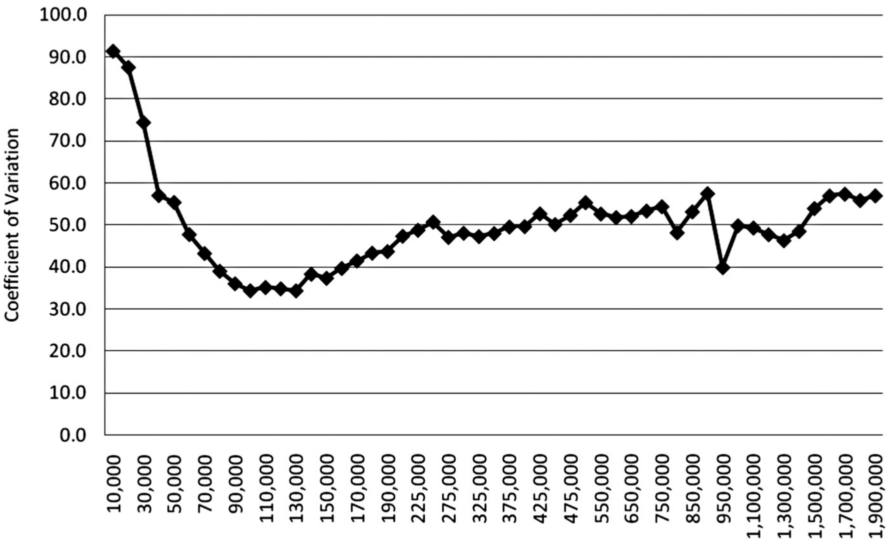
[21] Properties are divided into groups as follows. For properties with values between $10,000–200,000, groups are formed by $10,000 increments (i.e., all properties with values between $10,000–20,000 are Group 1, all properties with values between $20,000–30,000 are Group 2, etc.). Properties with values between $200,000–500,000 are formed into groups by $25,000 increments; properties with values between $500,000 to $1 million are formed into groups by $50,000 increments; and properties with values between $1 million to $2 million are formed into groups by $100,000 increments. I delete properties with values below $10,000 and above $2 million. This deletes fewer than 2,000 properties in any year. For 2006, this deletes 350 properties.

[22] The CV is a widely-used measure of horizontal equity and measures the relative dispersion in effective tax rates among members within a single group. It can be expressed as $CV_N = SD_N/Avg(T_N) \times 100$, where CV_N = the coefficient of variation of effective tax rates for group N, SD_N = the standard deviation of effective tax rates for group N, and T_N = mean effective tax rate for group N.

[23] Results for other years are available from the author upon request.

Figure 4

Coefficient of Variation for LVT Effective Tax Rate, by Property Value Group for 2006



ues (ranging from 34–39), consistent with greater horizontal equity. The CV values for properties valued at greater than $160,000 tend to increase as property values increase, but all CV values fall between 40–58. Results for other years (1997–2005) exhibit a similar pattern, with the very lowest-valued properties exhibiting the greatest variation in effective tax rates. This suggests that, under a LVT system, horizontal equity would be lower for the lowest-valued properties.

V. EVIDENCE ON VERTICAL EQUITY EFFECTS USING CENSUS TRACT INCOME DATA

All of the analysis above uses property value as a measure of household income. Property value as a measure of income has several advantages: (1) the amount is taxpayer-specific, (2) it is available for each year, and (3) it may better reflect lifetime income than an annual income measure. However, it is also useful to examine how changes in tax liability resulting from a LVT are related to *annual* income measures (Bowman and Bell, 2008). In this section, I examine how changes in tax liability are related to annual income measures, using data from the 2000 U.S. Census Bureau.

To use the census data, I must first match each individual parcel of real property with its corresponding census tract. This results in properties being grouped into 313 different census tracts.[24] Census tract data are annual measures for a group of households within a census tract. I use a census tract's income measure as a proxy for the income level of all residential properties in that census tract. I use three income measures from the census tract data: per capita income, median family income, and percentage of individuals below the poverty level. For each census tract, I also compute the median property value (using the 2000 TAD property data) and use this as a measure of household income for the census tract. This allows me to compare results using annual income measures with results using lifetime income measures. The income measures are highly correlated with one another. Per capita income and median family income are highly correlated (a correlation coefficient of 0.900), and median property value is highly correlated with per capita income and median family income (correlations of 0.852 and 0.826, respectively). The poverty rate is negatively correlated with the other income measures (correlations ranging from –0.715 to –0.905). Census tracts with greater annual income levels have higher property values and lower poverty rates.

I first provide an analysis similar to that in Table 3 above. For each income measure, I rank census tracts from high income to low income, and divide them into three groups — top 30 percent, middle 40 percent, and bottom 30 percent. I then use all census tracts in a group to compute the median change in tax liability (*Median*Δ*TL*) and the median percentage change in tax liability (*Median%*Δ*TL*) if a LVT were implemented.[25] Table 5 reports the results. Regardless of the income measure used to rank census tracts, Table 5 shows that residential properties in the highest-income census tracts would experience the largest average decrease in tax liability (in dollar terms), while the lowest-income census tracts would experience the smallest average decrease in tax liability. However, the median percentage changes in tax liability (*Median%*Δ*TL*) are more comparable across income groups, regardless of the income measure used to rank census tracts. *Median%*Δ*TL* values range from –25.2 percent to –28.2 percent for the high-income census tracts, –22.5 percent to –27.7 percent for the middle group, and –20.3 percent to –23.3 percent for the low-income census tracts. Overall, the Table 5 results are consistent with the Table 3 results above: the average decrease in tax liability (in dollar terms) is greatest for high-income taxpayers, but the percentage change in tax liability is comparable across income levels.

I next replicate Bowman and Bell's (2008) analysis using my sample of properties. Using a sample of 23 census tracts in Roanoke, Virginia, Bowman and Bell, compute the correlation between *Median%*Δ*TL* and several census tract income and housing measures. For my sample of 313 census tracts, Table 6 presents the Spearman correlations between *Median*Δ*TL* and several census tract income and housing measures

[24] An appendix, which describes the matching process in detail and provides a table with summary information for the 313 census tracts, is available from the author upon request.

[25] I compute the median change in tax liability and the median percentage change in tax liability separately for each census tract, using all properties in the census tract. I compute the median change in tax liability and the median percentage change in tax liability separately for each group (high, medium, and low), using all census tracts in the group. These are the amounts presented in Table 5.

Table 5

Differential Tax Incidence: Change in Tax Liability, by Census Tracts Ranked on Income Measures[1]

	Ranked by Per Capita Income	Ranked by Median Family Income	Ranked by Poverty Rate[2]	Ranked by Median Property Value
Top 30 percent (n=94)				
Median ΔTL ($)	(775)	(755)	(713)	(844)
Median %ΔTL	–25.2	–27.8	–28.2	–26.8
Middle 40 percent (n=125)				
Median ΔTL ($)	(530)	(467)	(488)	(496)
Median %ΔTL	–27.7	–22.5	–22.7	–24.6
Bottom 30 percent (n=94)				
Median ΔTL ($)	(166)	(175)	(179)	(157)
Median %ΔTL	–20.3	–23.1	–23.3	–22.8

Notes: *ΔTL* = Change in tax liability in dollars, and *%ΔTL* = Percentage change in tax liability.
(1) Each column presents results for the 313 census tracts, ranked into three groups based on the corresponding income measure.
(2) Poverty Rate groups are ranked inversely so that "Top 30 percent" includes census tracts with the lowest poverty rates, and thus the highest income levels.

(column 1), and between *Median%ΔTL* and the census tract income and housing measures (column 2). Table 6 also presents Bowman and Bell's results for ease of comparison.

Table 6 shows that *MedianΔTL* is significantly correlated with all income and housing measures. Residential properties in census tracts with higher income levels and lower poverty rates have larger decreases (or smaller increases) in their property tax liability in dollar terms. The housing measure correlations suggest that larger tax decreases (or smaller tax increases) are associated with larger homes, newer homes, homes in areas with higher occupancy rates, and homes in areas with higher homeownership rates (i.e., negative correlations). Larger tax increases (or smaller tax decreases) are associated with older homes and more crowded homes (i.e., positive correlations).

Results are markedly different when change in tax liability is measured as a percentage of a household's existing property tax liability. *Median%ΔTL* is not significantly correlated with any income measure, and only three of the housing measures. The *Median%ΔTL* results suggest that larger percentage tax decreases (smaller increases) are associated with newer homes, homes in areas with higher occupancy rates, and homes in areas with higher homeownership rates.

Table 6

Spearman Correlations Between Median Change in Tax Liability and Census Tract Income and Housing Measures (n=313)

	MedianΔTL	*Median%ΔTL*	Bowman and Bell (2008)[1]
Income Measures			
Per capita income	–0.510***	0.063	0.8048***
Median family income	–0.572***	–0.011	0.8495***
Poverty rate for individuals	0.583***	0.069	–0.7462***
Median property value	–0.637***	0.026	n/a
Housing Characteristics			
Median number of rooms per housing unit	–0.352***	–0.083	0.4874**
Percent of housing units built after 1990	–0.589***	–0.167***	0.1738
Percent of housing units built before 1940	0.526***	0.051	–0.3599*
Percent of housing units that are occupied	–0.349***	–0.096*	0.6087***
Percent of occupied housing units that are owner-occupied	–0.274***	–0.159***	0.4557**
Percent of owner-occupied housing units with more than one person per room	0.465***	–0.039	–0.5964***

Notes: Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.
(1) Bowman and Bell (2008) report Pearson correlations between *Median%ΔTL* and the income and housing measures (see their Table 5). For their sample size (n=23), significance levels of 1%, 5%, and 10% correspond to correlation values of 0.51, 0.40, and 0.34, respectively.

The correlation results are consistent with the Table 5 results. Residential properties in higher-income census tracts have larger decreases in their property tax liability when measured in dollars. However, percentage changes in tax liability are comparable across income groups, and there is no evidence that *Median%ΔTL* is related to household income level. This evidence differs from that of Bowman and Bell (2008), presented in the last column of Table 6. Bowman and Bell use *Median%ΔTL* to compute Pearson correlations with the income and housing measures. They find larger increases (or smaller decreases) in tax liabilities for residential properties in census tracts with higher income levels and lower poverty rates. In other words, Bowman and Bell's census tract results suggest that the relative pattern of tax changes would be progressive for Roanoke, VA. For Tarrant County, the census tract evidence suggests that the change would be neither progressive nor regressive. Of course, these results are merely simple correlations and do not control for other possible confounding factors. The relatively small sample size (i.e., 313 census tracts for Tarrant County and 23 census tracts for Roanoke) makes it difficult to use techniques such as multiple regression to help control for these other factors.

VI. EFFECTS OF CAPITALIZATION ON PROPERTY VALUES

The analysis above does not consider how replacing a property tax with a LVT will change property values due to the effects of tax capitalization. Changes in property values will shift wealth among current property owners. If a LVT causes a property's future tax payments to increase, then the property's market value will decrease. The decline in property value means that the tax burden is borne by the owner who holds the property at the time the law changes. On the other hand, if a LVT causes a property's taxes to decrease, the property's market value will increase and create a windfall gain for the current property owner. The effects of tax capitalization also depend on how soon land values are reassessed after a LVT system is implemented. In this section, I estimate the effects of capitalization on property values under two scenarios: (1) the case where there is no reassessment and LVT liabilities are based on current assessed land values, and (2) the case where land values are reassessed at the same time the LVT system is implemented. These two cases represent the boundaries on the range of outcomes. If land values are reassessed, but with some delay after a LVT is implemented, the tax capitalization effects would fall somewhere within this range.

A. Change in Property Values with No Reassessment of Land Values

Assume that V_0 is a property's gross-of-tax value, t_P is the property tax rate, r is the discount rate, and n is the number of years that future taxes are capitalized into current property values. Also assume that taxes are fully capitalized into market values. The property's current market value (V_1) can be expressed as:

$$(1) \quad V_1 = V_0 - V_1 t_P \sum_{i=1}^{n} [1/(1+r)^n]$$

Now assume that the property tax is replaced by a LVT which taxes land value at a rate $t_L > t_P$, and taxes building value at a rate of zero. If land values are not reassessed and current land values (LV_1) are used to compute LVT liability, then the property's market value under a LVT system (V_2) can be expressed as:

$$(2) \quad V_2 = V_0 - LV_1 t_L \sum_{i=1}^{n} [1/(1+r)^n]$$

Subtracting (1) from (2) yields the change in property market value (ΔV):

$$(3) \quad \Delta V = V_1 t_P \sum_{i=1}^{n} [1/(1+r)^n] - LV_1 t_L \sum_{i=1}^{n} [1/(1+r)^n]$$

ΔV is equal to the change in the present value of the expected tax liability associated with the property. This represents a one-time change in property value that would occur as soon as participants in the real estate market realized the LVT was going to be implemented.[26]

I use (3) to estimate the change in value for each single-family residential property for each year over the period 1997–2006.[27] I then compute the median percentage change in property value for each wealth group, where properties are divided into the same three groups as above. This represents the median percentage change in property value that would occur if a LVT replaced the property tax in that given year. Results are presented in Figure 5 below. For the first few years examined, the highest-valued properties would experience the largest median increase if the LVT were implemented in that year (10.7–12 percent), while the lowest-value properties would experience the smallest increase (5–7 percent). However, the median percentage change is about 11–12 percent for all groups in 2002 and later.[28]

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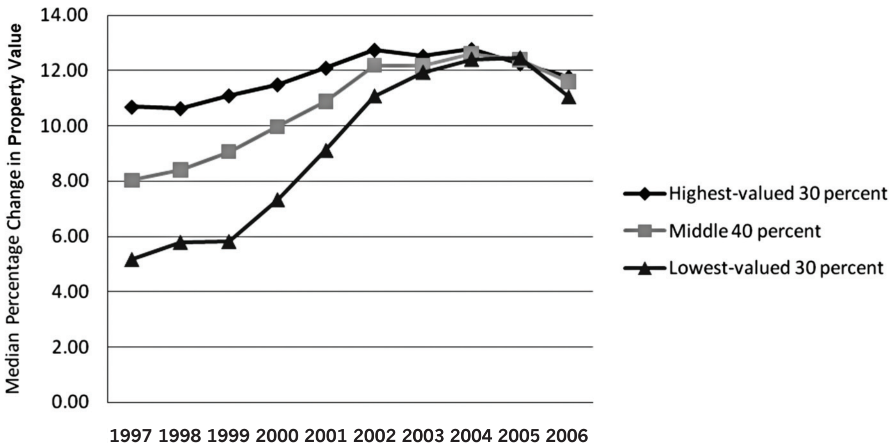
[26] This analysis treats changes in property values as a one-time immediate adjustment. However, changes in property values would likely occur over a longer period of time as discussions about changing from a property tax to a LVT progressed, and as uncertainty about the details of the LVT were resolved.

[27] Several assumptions are required, including values for t_P, t_L, r, and n. For t_P and t_L, I use the tax rates computed in Section IV. Do and Sirmans (1994) find that property taxes are capitalized into residential housing prices at a discount rate of approximately 4 percent, so I assume $r = 0.04$. Most empirical studies have found that property taxes are partially capitalized into property values (Sirmans, Gatzlaff, and Macpherson, 2008), although Palmon and Smith (1998) find evidence of full capitalization for a sample of single-family, owner-occupied properties. Ross and Yinger (1999) note that property tax differences may be less than fully capitalized if they are not expected to persist. Given the limited experience with a LVT in the United States (Dye and England, 2009), market participants could have some uncertainty over how long a LVT system will persist. Therefore, I assume that $n = 25$. This allows for significant, but partial, capitalization. In the subsequent analysis, I discuss how changes in assumptions would affect the results.

[28] If r were greater than 0.04, then value changes would be less extreme. For example, if $r = 0.07$, the median change in property values would be about 8 percent over the 10-year period. If n were greater (less) than 25 years, changes in values would be more (less) extreme.

Figure 5

Median Percentage Change in Property Value, by Group: Not Allowing for Reassessment of Land Values



Not all single-family residential property owners would experience an increase in property value under a LVT. Properties with higher tax liabilities would experience a decrease in value. Therefore, Figure 3 (Percentage of Properties with Tax Increase) can also be interpreted as the percentage of properties which would decrease in value. For all years, owners of the lowest-valued properties would be the most likely to experience a decrease in property value, although this percentage drops significantly over the period examined (from 36 percent to 15 percent). Owners of the middle 40 percent of properties are the least likely to experience a decrease in property value if a LVT were implemented.

B. Change in Property Values with Reassessed Land Values

A property's gross-of-tax value (V_0 in (1) above) can be decomposed into building value (BV) and land value (LV):

$$(4) \quad BV_0 + LV_0 = BV_1 + LV_1 + (BV_1 + LV_1)t_P \sum_{i=1}^{n} [1/(1+r)^n]$$

where BV_1 and LV_1 are the market values of building and land under a property tax system. Now assume that the property tax is replaced with the same LVT as above, but also assume that land values are reassessed at the same time the LVT is implemented. Property value can now be expressed as:

$$(5) \quad BV_0 + LV_0 = BV_0 + LV_2 + LV_2 t_L \sum_{i=1}^{n} [1/(1+r)^n]$$

where LV_2 is the market value of land under a LVT system.[29] Because (4) and (5) are equivalent, they can be set equal to one another, and rearranging yields the percentage change in building value ($\%\Delta BV$) and land value ($\%\Delta LV$) that arise because of the change in future tax payments:

$$(6) \quad \%\Delta BV = \frac{BV_0 - BV_1}{BV_1} = t_P \sum_{i=1}^{n} [1/(1+r)^n]$$

$$(7) \quad \%\Delta LV = \frac{LV_2 - LV_1}{LV_1} = \frac{1 + t_P \sum_{i=1}^{n} [1/(1+r)^n]}{1 + t_L \sum_{i=1}^{n} [1/(1+r)^n]} - 1$$

Building values increase by the present value of the expected tax liability under the property tax system, and land values decrease by the present value of the expected increase in tax liability under the LVT system.

I use (6) and (7) to estimate the percentage change in single-family residential building values and land values for each year over the period 1997–2006. This represents the percentage change in land values and building values which would occur if a LVT replaced the property tax in that given year. I then apply the percentage changes to the land and building components of each single-family residential property to compute a percentage change in total property value for each parcel.

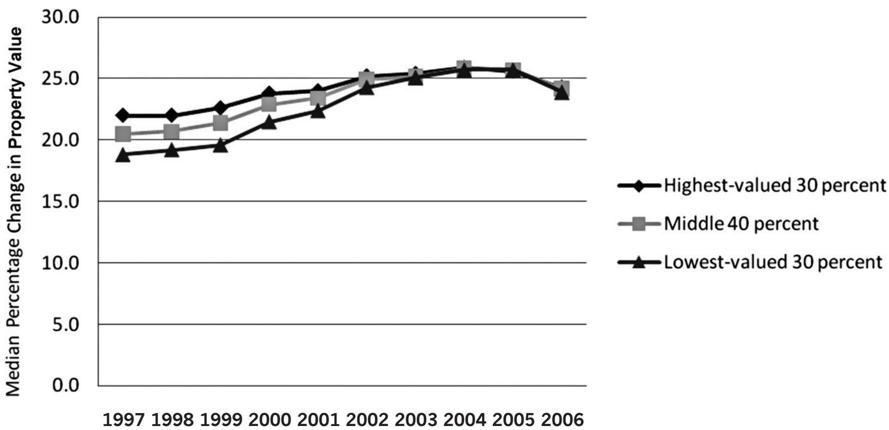
Results suggest that, if a LVT replaced the property tax, property values would increase for over 97 percent of single-family residential properties, and the median increase would be approximately 23.5 percent.[30] Figure 6 below shows the median percentage change in property value for each property wealth group. For the first few years examined, the highest-valued properties would experience the largest median increase (22–24 percent), while the lowest-valued properties would experience the smallest increase (19–22 percent). However, for 2002–2006, the median percentage change is about 25 percent for all groups. These later year results compare with an

[29] (5) assumes that gross-of-tax building and land values (BV_0 and LV_0) do not change after a LVT system is implemented. In the long-run, LV_0 may increase if eliminating the tax on buildings raises the level of improvements and increases the intensity of land use (Brueckner, 1986). For single-family residential properties, zoning restrictions may mitigate increases in improvement levels and land-use intensity, thereby lessening increases in LV_0.

[30] Land values would decrease a median average of 47 percent, while building values would increase a median average of 38 percent. (If $r = 0.07$, the median change in land, building, and property values would be –41 percent, 28 percent, and 16 percent, respectively.) This analysis uses a value of t_L based on existing land values. If a jurisdiction's total land value decreased in response to a LVT being implemented, then t_L would have to be larger to maintain revenue neutrality. A larger t_L value would not affect $\%\Delta BV$, but it would further decrease $\%\Delta LV$. When interpreting the Section VI results, it is important to remember that t_L is based on existing land values. I do this for tractability. This analysis should therefore be viewed as a first step in examining how a LVT would change property values due to the effects of tax capitalization.

Figure 6

Median Percentage Change in Property Value, by Group:
Allowing for Reassessment of Land Values



11–12 percent median increase in property values for all groups when land values are not reassessed (Figure 5).[31]

VII. CONCLUSIONS

This study uses parcel-level property data for Tarrant County for the 10-year period 1997–2006 to examine how replacing a uniform property tax with a LVT would shift the tax burden of owner-occupied, single-family residential properties. I find that a revenue-neutral LVT would shift the tax burden away from single-family residential properties and on to other property classes. Evidence on the distributional effects of a LVT suggests that the percentage change in tax liability is comparable across all property-value groups (low, medium, high), although the dollar change in tax liability would be largest for the high-value properties. Results using annual income measures to rank households are consistent with those that use property value. The analysis also

[31] The analysis in Section VI assumes that property taxes are capitalized at the same rate, regardless of property value. If tax capitalization was greater (less) for higher-valued properties compared with lower-valued properties, then the median percentage increase in property value would be greater (less) for higher-valued properties compared with lower-valued properties. Turnbull, Dombrow, and Sirmans (2006) find that larger houses have smaller unit prices than smaller houses in the same neighborhood, suggesting that tax capitalization is greater for larger houses. Eisenberg (1996) and De Bartolomé and Rosenthal (1999) find that capitalization is significantly higher for itemizers than for nonitemizers, suggesting that capitalization is greater for higher-income taxpayers.

suggests that the largest horizontal equity problems would arise for the lowest-valued properties. The effects of tax capitalization depend on whether or not land values are reassessed when a LVT system is implemented. If land values are not reassessed, results suggest that values for single-family residential properties would increase a median average of 5–12 percent. If land values are reassessed, then the median increase in property value would be about 19–25 percent.

Bowman and Bell (2008) propose that a LVT might be more politically feasible in jurisdictions in which the changes for homeowner-voters would most likely be beneficial. This suggests that a LVT would be more feasible in communities similar to Roanoke, Virginia, or Tarrant County (Texas) than to those more like Dover, NH, which has significantly higher land value ratios for single-family properties. The mean land value ratio for Dover's single-family homes is greater than for any other class of property in Dover (Table 4, England and Zhao, 2005), whereas in Tarrant County, the mean land value ratio for single-family homes is among the lowest of all classes of property.

It would be useful for future research to extend the distributional analysis of single-family residential properties to other areas of the country and to different jurisdictional types (e.g., rural, urban, central cities, suburban). This would increase our understanding of how a LVT would affect the tax burden across households and how that might affect taxpayer support for a LVT. Future research could also make a significant contribution by providing detailed analysis of how a LVT would shift the tax burden within the commercial and industrial property classes. Only one study has specifically examined the distributional effects of a LVT on business property (Haveman, 2004). It is also important for future research to analyze how a LVT would affect property values through tax capitalization effects, and how these value changes affect the calculation of a revenue-neutral LV tax rate. Most studies, including this one, calculate a revenue-neutral LVT rate based on existing land values. A more comprehensive analysis would calculate the revenue-neutral tax rate, taking into account changes in land values that result from the LVT's implementation. However, such an analysis requires one to estimate the effects of capitalization, reassessment, and construction on all land values in the jurisdiction (residential and business), which are in turn a function of the tax rate.

There is a great deal of public and legislative pressure to significantly constrain or even eliminate the property tax (Youngman, 2002; Brunori, 2003; Anderson, 2006; Fisher, 2009). Such actions would require that government services be reduced, or that revenues be increased through alternative local or state tax systems (e.g., sales or income taxes). These alternatives might address public and legislative concerns with the property tax, but they can be problematic in other ways, especially since these alternatives can diminish local government autonomy over tax policy and the provision of government services. As noted by Dye and England (2009, p. 4), "A strong case can be made for reforming the property tax instead of eliminating it." A LVT could provide an approach to significant property tax reform, while still maintaining local control over revenue sources. However, for the LVT to be seriously considered as a viable tax system, stakeholders must fully understand a LVT's equity effects, as well as its efficiency and development advantages.

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