Consistency of Land Values:
Comparison of Three General Approaches to Valuing Land Where There are Few Vacant Land Sales

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Abstract

Accurate land valuation is critical to land value taxation, which taxes land more heavily than improvements. In previous work we found three approaches to valuing the land component of improved properties. Using data for recently sold single-family residences in three study areas – one each for the three valuation approaches – this paper applies an hedonic pricing model to estimate in a single, consistent manner the land contribution to market value of sold properties. These estimated land values then are compared to the assessed values of land obtained from the localities.

About the Authors

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Introduction

This report addresses issues raised in our report for last year's David C. Lincoln Fellowship in Land Value Taxation, *Methods of Valuing Land for Real Property Taxation: An Examination of Practices in States that Require Separate Valuation of Land and Improvements* (Bell and Bowman 2006). In that report we investigated how land values used for property tax purposes were determined in four of the 29 states with legal requirements to value land and improvements separately for tax purposes. We intended to conduct case studies in four urban and four rural localities – one each in each of four states where separate land values are required – to learn more about how land values are derived. The four states selected were Maryland, Ohio, Pennsylvania, and Virginia. In the end, we studied more than two areas in both Virginia and Pennsylvania, but only one in Ohio, where we failed to gain the cooperation of private appraisal firms valuing smaller counties.

In those case studies we identified three different approaches used to value land for tax purposes, especially in jurisdictions where there are limited vacant land sales. These approaches, discussed in some detail in our earlier report, are only summarized here:

- ***Abstraction***, with land value representing the residual when the depreciated cost of improvements is subtracted from the value of the improved parcel;
- ***Allocation***, with land value calculated as a common, or typical, percentage of total improved parcel value; and
- ***Contribution*** value, with the contribution of land to total parcel value estimated by use of non-linear multiple regression of total parcel value on a number of parcel attributes, including attributes of both land and improvements.

Our concern here is that the primary valuation method used in a local jurisdiction to determine land value for tax purposes may make a difference in the final land value estimates. Each method attempts to arrive at market value of land, and all study areas stress the need to exercise judgment before adopting specific parcel values. Still, differences among the methods could affect valuation outcomes, in part because of the need to exercise judgment in their application.

More specifically, this project seeks to learn whether different approaches to valuing land for tax purposes result in different estimates of land value. We look at three different jurisdictions drawn from our second-year set of case studies, each of which uses a different one of the three valuation approaches discussed in our previous report:

- Roanoke, Virginia, which relies primarily upon the *abstraction* method to derive estimates of land value;
- Baltimore, Maryland, which relies primarily upon the *allocation* method to derive estimates of land value; and
- Lucas County, Ohio, which uses a set of estimation procedures that seem to us to be a

variant of the *contribution value* method to derive estimates of land value.

To determine whether differences in land values result from different valuation approaches, we compare the land value estimates obtained from the three areas to baseline estimates derived for each area using a single, consistent approach for all three areas. We do not evaluate the various approaches through this research, in part because we study only three localities. Rather, the purpose of the comparison is merely to determine the extent to which different valuation methodologies result in different estimates of land values for tax purposes. Before considering the derivation of the baseline land value estimates, we provide a review of the rather limited literature that has similarly sought to determine whether different valuation methods applied to the same data produce different results.

Literature Review

As noted, our current study examines whether different approaches to estimating land values yield different results when applied to the same data sets. We have found little in the literature reporting on such inquiry.

One sort of research explores how certain changes within a general approach to value estimation affect valuation outcomes. For example, the valuation staff in Lucas County (Toledo), Ohio, has worked to improve estimated values by refining the way in which location is measured and accounted for in the valuation models. They have reported these efforts in a number of papers that have appeared in the professional literature (see, for example, Ward, Weaver, and German 1999, and Ward, Guilford, Jones, Pratt, and German 2002). Models employing more sophisticated measurement of parcel location within Lucas County were found to improve valuation, as measured by statistics such as the coefficient of dispersion, when compared to models either lacking location variables or using cruder measures.

Our interest, however, is in the use of basically different approaches to estimating values applied to the same set of data for the same set of properties, to see whether the results differ. This part of the literature is thin, but emerging. The only paper we found that fits squarely in this line of research is a 2005 study by Moore, which is reviewed below. The work that we report here is a second example of such research, and another such study reportedly is being conducted for a doctoral dissertation at the University of Ulster (McCluskey 2006).

Because this report is an extension of our second-year David C. Lincoln Fellowship, we summarize the relevant portion of that report here. The purpose of that research was to carry out case studies in four states with legal requirements that land and buildings be valued separately for tax purposes, so that we could document the different approaches used to value land. At the outset, we expected to find differences between states, based on information gained in some of our earlier work that did not focus directly on the manner in which land values are derived. Differences between rural and urban localities also were expected due to differences in the availability of vacant land sales data.

Each of these expectations was borne out to some extent, but not completely. First, in all study

areas, we were told the state does not provide any specific guidelines – let alone requirements – for estimating land values. In this environment, differences exist not only between states, but within a state. Second, although we found the expected difference in land valuation approaches between areas with large numbers of vacant land sales and areas not in this position, not all urban areas fall within the latter group. For example, Fairfax County, Virginia – a county with over a million residents, located in the first tier of counties outside Washington, DC – was still placing primary reliance on land sales data in deriving land values.

The cases studies indicated that a common approach to valuing land for tax purposes in urban areas with insufficient vacant land sales relies on the depreciated replacement cost approach to valuation of improvements. This technique, often referred to as the *abstraction, or extraction, method* of valuing land (Eckert 1990, pp. 195-96; Wuensch, Kelly, and Hamilton 2000, p. 16), starts with the market value of the entire property and subtracts the depreciated cost of replacing the improvements. The residual is then attributed to land.

A second approach to valuing land when there are few land sales is the *allocation method*, which attributes, or allocates, a percentage of total improved parcel value to land. The land percentage is derived from market evidence and applied to individual parcels. The approach implicitly says that if land typically accounts for 25 percent of total value, for example, then 25 percent is the likely land share of value for a given property.

Finally, a third approach to determining market value of land for tax purposes is referred to as the *contribution value approach*. Market values emerge from arm's-length transactions for a number of properties. An informed buyer might be willing to purchase any of several homes on the market at a given time. However, because no two properties are exactly alike (they will differ at least in their location, however slightly), the buyer may not be willing to pay the same for each property. Differences deemed important will translate into different prices that the buyer will be willing to offer. Some features of a property may add either more or less than their replacement costs, as evaluated by the typical buyer. An old, but still sound barn on a site in an area no longer used for farming may add less to value than its replacement cost, in the eyes of buyers looking for only a residence. Such considerations suggest that the abstraction method may err in its generation of land values, and the allocation method may not do better.

Our third-year fellowship research, reported in this paper, explores the implications of using these different approaches to land valuation and the impact they have on differences in estimates of land value for tax purposes. We found one article that compares a number of different computer-assisted mass appraisal (CAMA) techniques in the valuation of individual properties. Specifically, Moore (2005) identified six methodologies for determining the assessed value of residential properties for local property tax purposes, including:

1. The direct sales comparison approach;
2. A multiple regression analysis (MRA), which is a statistical extension of the direct sales comparison approach;
3. An adaptive estimation procedure (AEP);
4. The cost approach, which relies upon local market analysis to provide an estimate of depreciation from all causes (physical, functional, and economic) and is the most

commonly used approach;
5. A hybrid approach that he calls the transportable cost-specified market approach; and
6. A final approach, based on artificial neural networks, that is not widely used in the profession (Moore, p. 43).

Moore then engaged, for each of the middle four methodologies commonly used in mass appraisal, analysts who were expert in their respective approaches. To focus on the comparative accuracy of the different valuation methodologies, all analysts worked with the same data set. Specifically, they were provided information on a randomly-drawn sample of 5,546 single-family residential properties in a Midwestern jurisdiction that had sold in verified arm's-length transactions in the 1999-2003 period. To measure the predictive accuracy of the four different methodologies, all analysts applied their model results to the characteristics of 1,299 single-family residential properties in the same Midwestern jurisdiction that sold in 2004. Their estimated 2004 values were compared to the actual 2004 sales prices of these properties; analysts did not have the sales price information for the 2004 sales when developing their valuations.

The study found statistically significant differences in predictive results, as measured by the coefficient of dispersion, between the major property valuation methodologies. It is particularly important from our perspective that the study concluded that a market-calibrated automated valuation model will predict selling prices more accurately than a cost-based model.

The Moore study is significant for our purposes because it apparently is a first attempt to apply different valuation approaches or methods to a single set of property data for the purpose of comparing the valuation outcomes. An important difference between it and our study, however, is that we focus on land values whereas Moore focuses on total parcel values; Moore provided analysts using the cost approach land values determined by the jurisdiction that were to be used as given data.

In a related type of study, Sirmans, Diskin, and Friday use different models to estimate the vertical inequity in the taxation of real property. They created a data base of a random sample of 1,508 owner-occupied residential property sales in Miami (Dade County) for calendar 1991. They then used five different models to estimate the extent of vertical inequity in the assessments for the subject properties. Their results were mixed, with some models showing a regressive tax and some showing a progressive tax. This is another example of using one data base to test the efficacy of different models, and the finding is that different models yield different results.

Data

The purpose of this project is to compare assessed values for land developed under each of the three valuation approaches identified in our previous report to baseline estimates derived from a hedonic pricing model. We use data for single-family residential properties in three localities drawn from the case-study areas in our second-year Lincoln Fellowship project, selecting one locality for each of the three valuation approaches. Specifically, we include Roanoke, which places primary reliance on the abstraction (residual) method; Baltimore, which places primary reliance on the allocation method; and Lucas County, Ohio, which relies on a variation of the

contribution value approach.

For each locality, we obtained a data file for single-family residential properties sold in a recent time period. We asked for total assessed value of each property, as well as the separate land and building values. In addition, we asked for the property-record information on the attributes of those properties so that this information could be used to develop a hedonic pricing model, so that we could make comparisons of valuation approaches similar to those reported by Moore, above. As noted below, we obtained more detailed information from some localities than from others.

Roanoke City

The City of Roanoke provided an Excel spreadsheet with data for 28,478 single-family residential properties. Three different columns give the three most recent sales dates for each property; we sorted on the most recent sales date. We eliminated 3,826 properties with no recorded sale date and another 18,027 that had sold most recently anywhere from 2003 back to 1905. That left 6,625 sales between January 1, 2004 and July 31, 2006; of these sales, 2,296 occurred in 2004, 2,670 in 2005, and 1,659 in the first seven months of 2006.

Next we sorted these 6,625 sales in 2004-2006 on the sales price for the most recent sale to eliminate 1,434 "sales" with zero prices. Of the 5,191 sales with non-zero prices, 1,328 occurred in the first seven months of 2006, another 2,087 occurred in 2005, and the remaining 1,776 sales were in 2004.

The Roanoke data set includes several variables to describe the land and a good many more to describe the improvements, as well as information on assessed values, sales, current ownership, legal description, and a unique parcel identification number. Land descriptors include neighborhood, zoning, lot size in square feet and in acres, lot frontage and depth, and topography; the latter variable records such things as steep slope and whether the lot sits unusually low or high. Variables to describe the improvements include year built, number of square feet, number of stories, total number of rooms, number of bedrooms, number of bathrooms with various numbers of fixtures, and many variables pertaining to type and quality of construction. In addition, there is information on such things as fireplaces, heating and cooling systems, garages, basements, attics, porches, and decks.

Baltimore City

Baltimore City indicated we would have to purchase the data from a private vendor, SpecPrint. We made our request to SpecPrint and, after some time, we received a file from them with 6,261 sales of residential properties from 2004 to 2006. Each observation had a number of variables from the property record card. However, it is not clear whether or not the information provided by SpecPrint includes all of the variables contained in the property record card and used in the CAMA system in Maryland to generate assessed values.

SpecPrint provided a copy of the Maryland Masterfile Layout for 2006, which lists 103 variables for which there should be information for each property. The data set we received from SpecPrint did not include any information for a number of variables on the Masterfile Layout list of variables for the Maryland valuation system, including the number of rooms in a house, the number of bedrooms, the type of foundation, and roofing material.

SpecPrint also included a list of Selected List "Field Parameters" that provides information on how to interpret the numbers included in several of the variables including building styles, condition, and construction type.

Lucas County

Lucas County, which includes Toledo, has too many residential parcels to allow putting information on all of them in a single Excel spreadsheet, so data were provided to us in Access. There are 170,963 residential property parcels, and 7,962 residential sales for the period from January 1, 2004 to the end of May 2006.

The Lucas County data set is rich and well-organized, with many variables describing both land and improvements. Among the materials provided are a 17-page Residential Definition Manual and smaller files that provide summary statistics – index values or weights – for various features:

- Air conditioning system or unit information;
- Basement type;
- Building condition;
- Economic obsolescence;
- Garage type;
- Construction grade;
- Heating system;
- Land influence factors;
- Neighborhood type, or development stage;
- Occupancy of structure – actually, number of dwelling units;
- Remodeling type, if any – total, kitchen, roof, exterior, etc.;
- Sewer or septic system type;
- Number of stories, including split-level, 1-1/2, etc.;
- Street type, including surface type, planned vs. actual street or alley;
- Traffic volume, by type of road;
- Wall material or type – wood, brick, stone, concrete, etc.; and
- Water supply, if any.

In summary, we have gotten a significant amount of data on recent sales of single-family residential properties in each of the three study areas. However, not all the areas were able to provide the same descriptive variables. This posed some challenges in the modeling needed to derive a consistent set of estimated land values in all three areas to be compared to those derived by the assessors in each of the study areas.

Methodology

At first, we considered building our own hedonic pricing model to generate baseline estimates for this project, with assistance from a general statistician. However, we concluded that the task was too large for our limited time and resources, including statistical talents. We also concluded that we needed statistical assistance from people already experienced in the analysis of property values, and we are fortunate to have obtained such assistance. Specifically, during our second-year fellowship, we were introduced to Dr. Robert Barr, CEO and President of 21st Century Appraisals near Harrisburg, Pennsylvania.

With many years' experience in applied statistical analysis of property data to estimate values, Dr. Barr and his colleagues have developed the analytic tools, experience, and perspective to generate land value estimates by applying a single approach to the data for all three study areas. They have developed a hedonic pricing model that they use to value properties in a number of counties in Pennsylvania. The approach is based on the contribution value concept and generates extremely good results, according to an independent review of assessment outcomes in Pennsylvania. According to an August 2004 study of assessment quality by Dr. Roger H. Downing, eight of the 14 counties in Pennsylvania that met or exceeded the assessment quality standards set by the International Association of Assessing Officers had been reassessed by 21st Century Appraisals.[1] The same study lists 10 counties that met or exceeded IAAO assessment standards for residential property, and 21st Century Appraisals had reassessed nine of the ten. Similarly, 21st Century Appraisals had reassessed five of the six counties that met or exceeded IAAO standards for commercial properties and four of the seven counties that met or exceeded IAAO standards for valuing vacant land (Downing 2004).

This project studies differences between land values estimated by 21st Century Appraisals' hedonic model, which serve as baseline values for comparison, and those estimated by each of the three jurisdictions using the different valuation approaches discussed above. We seek simply to determine the degree to which different methodologies produce different or similar land value estimates, not to evaluate the various approaches. We will not be able to go beyond saying that outcomes are essentially the same, or that there are some differences. The basic approach of 21st Century Appraisals is described in the firm's Mission Statement:

> 21st Century Appraisals' philosophical approach to mass appraisal is based on a market-driven system of valuation, balanced by the Income Approach and/or Cost Approach, where appropriate. If assessors are expected to defend values at hearings with comparable sales, then it seems logical that the CAMA system software used to establish these values should be based on a market-driven system. A market-driven system of valuation contributes to fairer real estate assessments. The replacement cost method, while needed and valuable, when used as the only method of valuation, has contributed more to poor uniformity of taxation in Pennsylvania than any one factor. Using market data to estimate cost depreciations is not enough. Values should be driven by market formulas. 21st

[1] There are 67 county areas in Pennsylvania, including the city of Philadelphia. One reason so small a number meet or exceed IAAO assessment standards is many go many years – decades in some instances – between reassessments.

Century Appraisals has developed and installed the only truly balanced market-driven CAMA system in Pennsylvania (http://21appr.com).

The 21st Century valuation approach is based on the contribution principle of valuation. "The principle of contribution applies to the parts of a property to determine the contribution of each part to the total value. Total value may not equal total cost of the individual parts" (Eckert 1990, 88). An example given to us to illustrate this principle was the recent construction of a number of townhouses. Some of the townhouses had a finished basement, while some had a garage instead of a finished basement. From the cost approach, finishing the basement as living space added more to value (cost) than using the space as a garage. However, from the market perspective, buyers valued off-street, protected parking and were willing to pay a substantial premium for the townhouses with garages.

Within this general framework, the models developed by 21st Century Appraisals are based on the sales comparison approach to valuation, which reflects the principles of supply and demand, contribution, and substitution. According to Eckert, the following general equation serves as the basis for the sales comparison approach:

$$MV_s = S_c + ADJ_c$$

where MV_s is the market value of the subject property, S_c is the sales price of a comparable property, and ADJ_c are adjustments made for quantitative and qualitative difference between the comparable and subject properties. Such a model can be calibrated using multistage or nonlinear multiple regression analysis (Eckert 1990, 338).

It is clear from this model that paired sales analysis is the foundation of single-property appraisal by the sales comparison approach. Such a paired sales analysis is based on the recognition that individual properties being compared are identical in all attributes except the attribute being measured – or that adjustments to other attributes have already been made. The assessor compares these sales and isolates the value contribution for the desired attribute (Eckert 1990, 156-57).

There is general recognition that the most important aspect of market analysis is location. In the paired sales analysis, geographic stratification generally is thought to provide a strong advantage in reflecting the impact of location on value because it is tailored to local supply and demand factors that may vary substantially across a jurisdiction. "Thus, the sales used to calibrate a given model will reflect the market influences and conditions only of that area, so more accurate and supportable models are produced" (Eckert 1990, 339-40).

To implement this approach to valuation, 21st Century Appraisals spends a lot of time early in a valuation exercise making sure that the data they use reflects true market sales and that the resulting observations are appropriately stratified to reflect important differences that affect value.

In developing estimated values for this study, 21st Century started by analyzing the data provided by the three jurisdictions examined in this project. Their first task was to determine valid sales.

If there was a validation code included in the data sets provided they relied on that code to determine valid sales. If such a code was not provided, they used their proprietary procedure for determining valid sales, which identifies outliers. If individual sales were suspect, for whatever reason, they were deleted from the data base used to calibrate their models to avoid having estimated values be based on bad information. This approach might lose some valid sales, but they want to make sure they have clean sales to calibrate the model. Normally they would visit sites that represent questionable sales to determine the facts of the particular cases that were flagged by their validation procedures. However, on-site inspections were not possible for this project. The result is a group of sales for each jurisdiction that they felt it was appropriate to rely on to calibrate their models.

Before proceeding to their statistical analysis, 21st Century ran an additional program to test the internal consistency of the data for each individual sale. They were looking for properties for which the data might not be internally consistent – e.g., an 1,100 square-foot house listed as having seven bedrooms.

The next step in their process was to develop a variety of stratifications of the sales file to reflect variations across properties in variables thought to impact sales prices. The first step in this process was to generate for each individual property measures of the grade, effective age, and condition of improvements on the property. Because market data indicate that values are similar for homes built within a certain range of years – for example, 10 to 20 years ago – rather than differing for each year within that range, each property was assigned to one of several multi-year age groups.

The properties in the sample were then stratified by age group, story type (e.g., one story, one and one-half stories), and neighborhood to reflect variables that influence market value. As mentioned above, location is a critical factor in determining sales price, so the neighborhood variable is critical for their stratification process. In analyzing our three study areas, 21st Century accepted the neighborhood designations provided by the individual jurisdictions, omitting additional analyses that they ordinarily would undertake in a revaluation effort to insure the best possible delineation of neighborhoods.

The result of the stratifications is a three-dimensional matrix with a number of observations in each cell. Statistical analysis is then carried out on the sales within each cell to identify the contribution value of each attribute of the improvements. Using the resulting coefficients, adjustments are made to individual properties for each attribute depending on the extent to which they diverge from the average property in each cell. In this manner, they are able to reflect the impact of the market on each individual attribute for each property.

Normally, 21st Century carries out a similar analysis of land values based on land sales. However, in the three jurisdictions examined, there were not adequate land sales to conduct such an analysis – our focus is on valuation of land in areas where there are few sales of vacant land. In essence, they treat land as a residual here. This sounds much like the land abstraction approach, but there is an important difference between 21st Century's approach and the typical application of the abstraction method. The difference arises from the procedures 21st Century has developed to derive improvement values based on the contribution principle of value, which

generally differ from those resulting from the traditional cost approach to valuation.

To provide values derived in a single, consistent manner for all three study areas, 21st Century Appraisals used a standard set of variables for all three jurisdictions; this was important for our use of their values as baseline values. In carrying out the analyses, however, it was necessary to provide separate stratifications and matrices for each jurisdiction, because they are different areas. In essence, each of the three localities was treated as a "super neighborhood" within the overall valuation exercise.

The basic form of their model is nonlinear, multivariate regression. The nonlinear form is needed to allow the true relationships between the market value of the property and the contribution value of individual attributes to be captured. For example, a lot-size increment of 5,000 square feet probably adds less to value in going from 25,000 square feet to 30,000 square feet than in going from 5,000 square feet to 10,000 square feet. Similarly, a third bathroom may not add as much value as the second one.

In preparation for the modeling exercise, the analysts at 21st Century subjected the data from Roanoke, Baltimore, and Lucas County to their procedures, including tests for valid sales data to screen out obvious outliers, because not all localities had provided data screened to incorporate only arm's-length market transactions. Parcels with insufficient data for value analysis also were removed from the data sets provided by the localities. In the end, 21st Century used information for 3,622 Roanoke properties sold in 2004-2006; 3,063 Baltimore properties sold in 2004-2006; and 6,341 Lucas County properties sold in 2004-2005.

Results

As noted above, our previous study identified three methods of valuing land for tax purposes in urban areas with limited residential sales information – abstraction, allocation, and contribution value – and in this study we explore whether land values differ depending upon the valuation approach used.

The three approaches are intended to arrive at the same result – estimates of market value for tax purposes – and in principle perhaps they should. Our hypothesis, however, is that in practice the different approaches could well result in different values of land for tax purposes, in part because the mechanics of the three approaches differ so much. To test this hypothesis, we obtained data from three case study localities, one for each of the three basic approaches listed above:

- City of Roanoke, which uses abstraction as the primary approach to estimating land values;
- City of Baltimore, which uses allocation as the primary approach to estimating land values; and
- Lucas County, which uses a very involved set of estimation procedures that seem to us to be quite similar to the contribution value approach.

As also noted above, we obtained the services of 21st Century Appraisals, which provides

valuation services in a number of Pennsylvania counties, obtaining extremely good results using its own, proprietary valuation methodology. 21st Century agreed to use its contribution-based model to calculate baseline estimates of land value for residential properties in each of the three jurisdictions included in this study, using data that we had obtained from the three case study localities. Thus, for each of the three study areas, two sets of land values are available for the set of residential properties, one from the locality and one developed by 21st Century Appraisals.

Average Land Share of Total Value

A simple test of the similarity or divergence of the two sets of land values is provided by the (mean) ratio of land value to total value. This is an important statistic in any form of land value taxation, which places a higher tax rate on land than on improvements. The tabular presentation, below, presents the average land share of improved residential parcel value as estimated by each locality and as estimated by 21st Century Appraisals for each locality, followed by the ratio of the local average to the average calculated by 21st Century.

Land Share Statistic	Average Land Percentage of Improved Residential Parcel Value		
	Roanoke	Baltimore	Lucas County
Local estimate	18%	32%	20%
21st Century estimate	22%	20%	23%
Local/21st Century	0.8182	1.6000	0.8696
Exhibit: *n*	3,622	3,063	6,341

The average land percentage of total value estimated by 21st Century Appraisals differs from the local estimate for all three localities. The two estimates are closest for Lucas County, where the local land ratio (20 percent) is about 87 percent of the 21st Century-calculated land ratio (23 percent); the greatest divergence is found in Baltimore, where the local land ratio (32 percent) is 160 percent of the ratio determined by 21st Century (20 percent); and Roanoke falls in between, but closer to the Lucas County situation than to the Baltimore situation. Roanoke's data place the average share of improved residential parcel value represented by land at 18 percent, while 21st Century estimates 22 percent of value is attributable to land.

Variability in the Two Land Value Estimates for Individual Parcels

While there is interest in the share of total improved parcel value represented by land, even greater interest should attach to the estimates of the absolute value of land. This is the figure that would be the tax base for the land component under any form of land value taxation, and it is, of course, one of the figures underlying the land ratios just considered. The dollar-value estimates of land value are what we had in mind when we hypothesized different results under different methodologies.

<u>Coefficients of Dispersion</u>

One measure of variability of the two land value estimates for each study area is the familiar coefficient of dispersion, which has the advantage of using the data for each property in the study group. Typically, the point of departure in calculating the coefficient of dispersion is the ratio of estimated (assessed) value to the sale price for each property in a set of properties for which valid sales data are available. The coefficient of dispersion measures the average absolute deviation of the individual parcel ratios from the median ratio as a percentage of the median ratio. If sale price were equal to assessed value for each parcel in the sample, the coefficient of dispersion would be zero, as there would be no deviation between the assessor's estimates of value and the value determined in arm's-length market transactions; in fact, the CD value would be zero if the assessed value for each property were any constant percentage of market value. The greater the difference between assessed values and sales prices across properties, the larger the value of the coefficient of dispersion.

In working with improved parcels, however, sales data are not available for the land component of the parcel alone. Nonetheless, 29 states in the United States require separate valuations for land and for improvements, and this split is of critical importance under any sort of land value taxation, such as the split-rate, or two-tier, taxes found in several Pennsylvania municipalities.

To gauge the similarity or difference in our two sets of land value estimates for each of the three study areas, we use the baseline estimates developed by 21st Century Appraisals in lieu of sale prices since the sale price of land cannot be determined for developed residential properties in urban areas. Just as market sales data provide a standard "yardstick" against which to measure assessed values in the standard coefficient of dispersion calculation, the baseline estimates developed by 21st Century Appraisals also can serve this purpose because they were developed using a standard approach. We stress that in using the 21st Century value estimates in this manner, we are not assuming that they are better estimates than those developed by the three localities. Our interest is in whether different approaches result in different value estimates; with only three study areas, we are not able to conclude what approach is best. That should be the subject of future research, if the finding is that different approaches produce different value estimates.

Using data for the several thousand parcels in the data set for each locality, we calculated for each parcel the ratio of the local value to the 21st Century value, subtracted the median ratio from the individual parcel ratios, determined the absolute values of those differences, determined the average absolute difference for the parcels in the data set, and expressed that average absolute difference as a percentage of the median ratio. The resulting coefficients of dispersion are as follows:

- Roanoke, 32.0 percent;
- Baltimore, 44.0 percent; and
- Lucas County, 23.1 percent.

Thus, we find that there is substantial variation in the land values for individual parcels that emerged from the two different estimation approaches in each study area. Even the smallest of the three CDs, at 23 percent, is above the level acceptable in residential valuation under IAAO guidelines. For the focus of our study, however, it seems even more important that the

coefficients are different for the different areas – and, hence, for the comparisons between the three different valuation approaches compared to the baseline approach for this study, the approach used by 21st Century Appraisals.

The extent of variation is greatest in Baltimore (CD = 44 percent), where the local approach is allocation, and smallest in Lucas County (CD = 23 percent), where the local approach uses a variety of statistical procedures intended to isolate the individual contributions to value by various property attributes. Roanoke, using the abstraction approach to isolating land values of improved residential parcels, falls in the middle (CD = 32 percent). As previously noted, 21st Century uses a contribution value approach.

Reflecting on these results, the outcome seems logical. Both 21st Century and Lucas County use approaches that seek to consider the individual value contributions of each of several property attributes, and these two sets of estimates match more closely than the two estimates for the other two localities. The deviations are greatest in Baltimore, which relies primarily on the allocation approach to estimating land value; this approach seems to give less attention to parcel-specific attributes. Roanoke, using the abstraction approach, is in the middle of the results as measured by the coefficient of dispersion, and also seems to be in the middle of the pack in terms of the use of parcel-specific information in developing land value estimates.

Price-Related Differentials

Another standard measure of assessment performance is the price-related differential (PRD), which tests for systematic bias in the valuation of high- or low-value properties. Like the coefficient of dispersion, the PRD is derived from assessment-sales ratios for individual properties. As traditionally applied, the PRD is calculated as the mean of the individual parcel ratios divided by the weighted mean ratio; the latter is calculated as the sum of assessed values for all parcels in the sample divided by the sum of all sales prices for the same properties. The mean ratio gives equal weight to each parcel while the aggregate ratio is influenced more by properties for which the values are larger. Thus, if the aggregate ratio is larger than the mean ratio, which gives a PRD of less than 1.0, it means higher-value properties are relatively over-assessed – assessment is said to be progressive – while a PRD above 1.0 indicates systematic relative over-valuation of lower-value properties, termed regressive assessment; allowing for the fact that assessments will not be perfect, the IAAO has considered PRDs within a range of 0.98 to 1.03 to be acceptable (Eckert 1990, 539-42).

Because we are considering assessment of land values rather than total values of improved parcels, we do not have sales prices to pair with the assessed values for the land component. As in the case of the CDs reported above, we have used the values estimated by 21st Century Appraisals as the baseline values, in place of sales prices. Thus, the PRDS – like the CDs – provide measures of local valuation consistency relative to the 21st Century values. Keeping in mind that our interest is in determining whether different land valuation approaches yield different valuation outcomes, we again stress that this was done simply to provide consistent baseline assessment figures across jurisdictions.

Mean ratios for both Roanoke and Lucas County are below unity (0.898 and 0.957, respectively), indicating that locally-developed land values for individual parcels are below those developed by 21st Century Appraisals for a majority of parcels; the opposite is true for Baltimore (mean ratio = 1.125). Aggregate ratios for all three localities are less than 1.0, with the highest occurring in Baltimore (0.959), followed by Lucas County and Roanoke (0.914 and 0.878, respectively); thus, total estimated land values derived by 21st Century are higher than total estimated land values developed by the locality for each study area. Combining these two measures of average assessment level results in the following PRD values:

- Roanoke, 1.0227;
- Baltimore, 1.1737; and
- Lucas County, 1.0471.

As all three PRD values are above 1.0, some local assessment regressivity is indicated, when using the 21st Century baseline values as the yardstick against which local values are measured. In other words, local valuation methods tend to place relatively more value on lower-value properties than is the case for the 21st Century methodology. The degree of regressivity is quite low in Roanoke, somewhat higher in Lucas County, and substantially higher in Baltimore.

Correlations Between Variables

In addition to the analyses reported above, we also calculated selected coefficients of correlation for each locality's data. Of obvious interest is the correlation between the two estimates of land value – those developed by the locality and by 21st Century Appraisals – for each locality. Not surprisingly, the correlations are high and positive, but clearly not perfect:

- Roanoke (abstraction method), 0.76704;
- Baltimore (allocation method), 0.76025; and
- Lucas County (detailed analyses similar to contribution value), 0.81012.

Although the local estimates and the 21st Century estimates differ, they generally move together.

By this measure, the correspondence between the local estimates of land value and those developed by 21st Century Appraisals again is greater in Lucas County than in Roanoke and Baltimore. However, in a departure from the findings for average land ratios and for coefficients of dispersion, the correlations between the two measures are essentially the same for Roanoke and Baltimore. The close similarity of the correlation coefficients for Roanoke and Baltimore indicates that the two measures of land value generally move together to roughly the same degree; however, it does not measure the degree of difference between the two measures. Thus, there is no contradiction between the findings for correlation coefficients and those for land ratios and CDs.

Each locality's data set includes data on residential sales in either two or three years, and we were curious as to whether the year of sale was associated with differences in land value estimates. The correlations are uniformly weak, whether the dollar or the percentage measure of

land value differences is used:

- Roanoke, 0.00087 (-0.01265 using the percentage difference in values);
- Baltimore, 0.08564 (0.07642 using the percentage difference in values); and
- Lucas County, 0.01987 (0.01551 using the percentage difference in values).

For each of the study areas, a considerable span of time is represented by the years in which the residential structures were built, which is related to when an area was developed. In working with improved residential parcels, the structures have to be reckoned with in some fashion to arrive at separate land values, and there is evidence in the literature that older structures make accurate, uniform assessment more difficult (Bowman and Mikesell 1990, 226). However, year of construction is very weakly associated with the differences in land value estimates, although it is somewhat stronger for Lucas County, when the percentage differences in values are used, than in the other cases:

- Roanoke, -0.00603 (-0.06008 using the percentage difference in values);
- Baltimore, 0.02089 (-0.09536 using the percentage difference in values); and
- Lucas County, 0.05213 (-0.16417 using the percentage difference in values).

Summary and Conclusions

This study was undertaken to provide an initial determination of whether land values for improved residential parcels are influenced by the particular valuation methodology, or approach, employed in an assessing jurisdiction. It builds on our second-year David C. Lincoln Fellowship study in which, through a series of case studies in four states that require separate values for land and improvements, we identified three basic approaches to estimating land values in areas where there are few sales of vacant land. For this study we obtained data from three of those case-study areas for residential properties that had recently sold, including the localities' assessed values for land and for improvements. Each of the three areas places primary reliance upon a different one of the three basic land valuation approaches identified by the case studies: Roanoke, Virginia, the abstraction method; Baltimore, Maryland, the allocation method; and Lucas County, Ohio, a contribution-value approach.

In addition to these locally-determined values, we obtained a second set of land values for each of the three localities, developed for us by 21st Century Appraisals using its proprietary contribution-value methodology. Thus, for each study area we have been able to compare two sets of residential land values developed from the same data set using two different valuation methodologies. We use the 21st Century values as baseline estimates because they provide values for each locality prepared using a single, consistent methodology. This use of the 21st Century estimates does not indicate a belief that these estimates are better than the local estimates; in this study we are concerned only with whether values differ with methodologies.

Differences in Results from Different Valuation Methods

We have considered several sorts of evidence on differences between the two sets of land values available to us for each of the three study areas – mean land ratios, coefficients of dispersion, price-related differentials, and correlations between the two sets of values. The mean land ratios give the average percentage of improved residential parcel value represented by land for each set of land value estimates; the coefficients of dispersion provide a summary measure of the extent to which the local estimates of land value differ from the 21st Century Appraisals baseline estimates; the price-related differentials provide a summary indication of whether the local valuation methodology produces land value estimates that – measured against the 21st Century baseline estimates – systematically favor either high- or low-value properties; and the simple correlations between the two sets of land values for each locality indicate the strength of the relationship between the two values.

Each measure provides evidence that valuation results differ with valuation methodology.

- The mean land ratios are higher for the 21st Century estimates than for the local estimates in both Roanoke and Lucas County, but in Baltimore the local approach (allocation) produced a higher land ratio than the 21st Century contribution-value estimates.
- The coefficients of dispersion (CDs) are rather large (from 23 percent in Lucas County to 44 percent in Baltimore), indicating substantial differences in individual-parcel land values under the two approaches in each setting.
- The price-related differentials (PRDs) for the three areas all are greater than 1.0, indicating at least some degree of regressive assessment of land values under the local methodologies, compared to the baseline values developed by 21st Century Appraisals; they range from 1.023 in Roanoke to 1.174 in Baltimore. The Roanoke PRD is low enough to be considered indicative of value-neutral assessment (again, relative to the 21st Century baseline) under IAAO guidelines.
- The correlations between the 21st Century Appraisals baseline contribution-based land values and those developed under the local land valuation approaches are high and positive for all three areas, but because they are not very close to 1.0 (they range from 0.760 in Baltimore to 0.810 in Lucas County), they indicate differences between the two sets of land value estimates.

The differences between 21st Century baseline, contribution-based land values and locally-determined land values are greatest for Baltimore, where primary reliance is on the allocation method. This is true for all four measures, although the difference in the three areas' correlation coefficients is quite small, especially when comparing the correlations for Baltimore and Roanoke. This result seems reasonable, given that the allocation method generally uses less parcel-specific information in arriving at land values than either of the other two methodologies. Lucas County generally is at the other extreme, with differences between the two sets of land values being smallest in Lucas County for three of the four measures; the exception is the PRD, which is lowest for Roanoke, although that for Lucas County is not substantially higher. Lucas County's land valuation approach can be described as a variant of the contribution value approach so, although the exact methodologies employed by Lucas County and by 21st Century Appraisals differ, their similar philosophic approach makes the greater similarity of their land value estimates not too surprising; each considers many variables in estimating values.

Implications for Policy and Further Research

Because each of the various valuation methods generally is intended to produce estimates of market value for individual properties, they generally are assumed to be alternative routes to the same end – a choice to be informed by whatever considerations the assessors find important but that is not likely to have substantive implications. We hypothesized that in practice, different methods, or approaches, to valuing improved residential land in areas where there are few sales of vacant land logically could produce different estimates of value. We tested this hypothesis using data for three case study areas and found that different results do, indeed, flow from different valuation methods.

This is an important finding. Anywhere that land value taxation is employed, with land taxed at a different rate from that applicable to buildings and other improvements (zero, in the case of site value tax), it is important that land be valued as accurately as possible. If different valuation methods produce different estimates of value, the relative taxes of various property owners are influenced by a choice currently seen as simply and administrative choice, not the policy choice that it may turn out to be. Although the majority of states in the United States require separate values for land and improvements in the property tax process, the division of total between these two components currently affects tax liabilities only in the several Pennsylvania municipalities that have opted for the split-rate, or two-tier, real property taxes available to them under state law. However, interest has been expressed in split-rate taxes in some other states in recent years, and there are many other countries in which some form of land value tax is employed.

Because our findings arise from examination of just three case study areas – one for each of the three approaches to valuing land where there are few vacant land sales – it will be important to conduct similar research in other settings to determine the robustness of our findings.

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