Do Property Assessors in Kentucky Value Residential Property at Fair Market Value?

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April 2007

Abstract:
Assessors are required, as mandated by the Kentucky State Constitution and KRS 132.690, to assess property at 100 percent of fair market value. Fair market value is defined as the price a seller would expect to receive in an open and competitive market. Evidence from data and analysis in this paper indicates that property is under-assessed by approximately 25 percent. Though urban areas assess at a slightly higher rate, this is offset by rural areas, which do a significantly poorer job. This has important implications for local communities in Kentucky that depend on property tax revenue in order to provide necessary goods and services to residents of those communities. Further, inaccurate property assessments distort the current school funding formula used in Kentucky that provides state funding to schools based on the value of properties in each school district.

Multiple econometric tests, including a rational expectation test and a hedonic price model, are conducted to analyze the quality of PVA assessments for 199 homes throughout Kentucky. These assessments are compared to certified appraisals for each home, which also contain market data for 3 comparable properties. The use of these appraisals as a proxy for fair market value is validated by econometric analyses that show the appraised value is an unbiased estimate of the market price of property and that appraised value is subject to only a small measurement error, about 3.5 percent of the variance across all property values. Further, evidence suggests that assessed values appear to be a scaled version of the unbiased appraised values.

Introduction:

Property taxes support communities in many ways. The collection of these taxes is a necessary condition for a community to provide goods and services to its residents. In order for property taxes to be collected, property must first be assessed; local governments have given this assessment responsibility to the Property Valuation Administrator. The PVA, an elected official in almost all communities across the country, is tasked with assessing all real property in a community so that community can then, based on local property tax rates, properly collect property taxes owed by its residents. Because the amount of taxes owed is largely a factor of the value of assessed property, a PVA has the great responsibility of determining the correct worth of that property.

In Kentucky, real property is to be assessed at 100 percent of its fair market value by an elected PVA. The most current Kentucky Constitution, adopted in 1891, states that, "All property, not exempted from taxation by this Constitution, shall be assessed for taxation at its fair cash value, estimated at the price it would bring at a fair voluntary sale." According to the Jefferson County PVA website, "fair cash value" and "market value" are to be considered synonymous. Further, the International Association of Assessing Officers (IAAO) in Property Appraisal and Assessment Administration states that market value is the price a property would sell for in a competitive and open market.

The fair assessment of property in communities is a necessary function of local government. Indeed, the public policy problem surrounding this issue is that an incorrect assessment of residential property negatively impacts communities that depend on accurate assessments in order to collect property taxes necessary for the county to provide goods and services for its citizens. Should an assessor value property more than

its fair market value, residents may seek out other communities in which to live in order to escape what they perceive to be unfair taxes. Should an assessor value property less than its fair market value—and forget for a moment that this is against the law—a community loses out on needed tax revenue. Of course, a community might compensate this potential loss of revenue due to under-assessments by raising tax rates, but raising taxes is an often unpopular move. One might theorize that property assessments are undervalued precisely to avoid paying higher taxes.

It should be noted that for the purposes of this paper, the terms "assessor" and "PVA" are synonymous. In Kentucky, the PVA is the chief elected official in each county responsible for assessing property. However, depending on the size of the PVA office there may be other non-elected assessors employed by the PVA who assess property in the county. The term "appraiser" refers to an individual who is hired to conduct an official appraisal—often at the request of a homeowner—for determining the value of a home. "Appraiser" and "assessor" are not synonymous.

Kentucky has had a property tax since 1792 and though it is an often unpopular tax Kentucky voters have yet to demand measures such as those passed in California and Massachusetts that would either cap property assessments at a certain percentage or cap the percentage amount by which property taxes can be increased. Property tax revenue remains an important source of revenue for counties. According to the Department of Finance for Lexington-Fayette County, revenue from property taxes exceeded $44 million dollars in FY 2006. This revenue was used to support services provided by LexTran (Lexington's public transit authority), garbage collection, street cleaning, the health department, and especially the public school system. Under the Kentucky

Education Reform Act, state funding of local school districts is, in part, determined by property assessments. The Support Education Excellence in Kentucky funding formula uses the value of property assessment in counties as a variable in determining how much funding the state will provide to each district. In short, districts with lower assessed property values are eligible to receive more state funding than districts with higher assessed property values. Accurate property assessments ensure that districts throughout the state receive the funding from the state that they deserve.

The assessment process is not an exact science; though property is supposed to be valued at fair market value, determining that value is, at times, quite difficult. After all, how does one determine the value of a home that has not been "on the market" in many years? How should an assessor determine the value of a home for which the value is not easily determined? An econometric interpretation of this question is: how much measurement error exists in assessments? This paper estimates the measurement error below.

There are three approaches one might use when assessing the value of a home—the cost approach, the income approach, or the market comparison approach. The cost approach involves determining what it would cost a homeowner to rebuild from scratch, i.e. replacement cost. The income approach uses rental income data to value the home; how much an owner could receive in rent is the basis for determining the home's worth. The most common approach, the market comparison approach, involves the use of known market values for similar properties to determine the value of the property being assessed. However, assessors do not use one approach—assessments typically involve the use of some combination in an effort to accurately value a home. Properties are assessed based

on the value of similar properties in the area, the price per square foot builders charge for home construction, and the value of external improvements to the property and/or land.

The process by which an appraiser values a home is very similar to the process used by a county property assessor. However, there is one key difference in the two processes: though an assessor is not explicitly forbidden from entering a home, Kentucky law is silent on whether an assessor has permission to inspect a home from the inside. Thus, any improvements in the house such as a finished basement or attic would not be captured by a property assessment but would be included in a report from an appraiser who was allowed to enter and inspect the inside of a home. This difference is important in understanding the research question to be discussed. If the greater information available to appraisers is useful, then the measurement error in appraised values is less than the measurement error in assessed values.

Research Question:

Correct assessments of residential property—as discussed previously—are a necessary condition for determining the property taxes owed to a community by its residents. The purpose of this paper is to ask, "Are Property Valuation Administrators correctly assessing residential property in counties throughout Kentucky?" Additionally, is the difference between assessed value and appraised value consistent throughout the state or are certain communities more at risk for assessment inequities? Are assessors systematically under-assessing homes in their communities or is the difference between assessed and market values essentially random variation?

To evaluate the accuracy of assessment, a "gold standard" is needed. A candidate for this is the appraised value of a home. To examine the accuracy of this assumption, two approaches are used in this paper. The appraised value of a home in this data set is

not necessarily the fair market value of the property. Other factors, not measured in the appraisal such as school districts, proximity to parks and greenspaces, help to determine the market value of a home. These exogenous features may or may not be captured in an appraisal or in an assessment. To examine the appraised value, three comparable properties valued by the market are associated with each property in the sample. If the appraised value is an unbiased measure of market value, there should be a precise relationship between appraised value and market value of comparable property. Specifically, the market value should be predicted with the correct average subject to random variation. This is tested below. Second, the variation in market values of comparable properties is a measure of the uncertainty, or technically measurement error, of the appraised value. This can be used to estimate any impact of measurement error on the statistical estimation.

Even if the appraised value of a home does not represent the full fair market value, it is a better indicator of the market than the assessed value for two reasons—because local governments indicate that this is their belief and because there are difficulties with assessing property at 100 percent of fair market value. Through my work as a research assistant with the Hazard Mitigation Grant Project, I have encountered many grant applications for FEMA-sponsored home acquisition projects from local communities where a "multiplier" has been added by the community onto the official PVA assessment in order to arrive at the fair market value (see Appendix 1). In effect, these communities are indicating by their actions that their local PVA is not assessing property at 100 percent of the fair market value, as required by law.

But it is possible that it is quite difficult for a county PVA to accurately assess properties at the legally required limit. Fair and accurate assessments depend on a full range of market data. After all, if an assessor is using the market comparison approach and there is no market to compare the home to, how can an assessor know the fair value of a home? And, as one PVA admitted, "In the end, you don't know the market value of a home until it's sold." This implies that assessments could not be perfect but does not imply that they must be under-assessed.

Besides the current Kentucky State Constitution, Kentucky Revised Statute 132.690 requires that each property parcel be assessed annually—at fair market value—and visually inspected at least once within a 4 year period. But in 1965, the Kentucky Court of Appeals found that on average real property in the state was being assessed between 12.5 percent and 33 percent of its fair market value and ruled that in accordance with the State Constitution, real property must be assessed at 100 percent of the fair market value. The Court found, "It is not only admitted but has become a matter of common knowledge that real estate and tangible personal property in Kentucky are assessed for tax purposes at varying percentages substantially less than 100 percent of fair cash value" (Russman v. Luckett, 391 S.W. 2d 694; 1965). It is probable that homeowners throughout the state are aware of past under-assessments. Bringing these assessments up to fair market value would then, be quite difficult. Any unexpected increase in an assessment could possibly create voter unrest and assessment appeals. Essentially, the entrenched system of under-assessment is the known problem with assessing at 100 percent of fair market value.

Again, the purpose of this paper is to analyze property assessments from homes throughout the Commonwealth and compare those assessments to appraisals for those homes in order to determine if real property is being under-assessed throughout the Commonwealth and if so, by how much. In addition, appraisals are compared to market values to provide evidence of whether appraisals are sufficiently accurate to be used as a standard.

Unit of Analysis:

The units of analysis for the purposes of this study are individual residential properties across Kentucky. Specifically, the properties in the data set are homes that have sustained flood damage or are at high-risk for sustaining flood damage and have either been acquired by the communities in which they are located using FEMA funds or have been identified as possible acquisition projects using FEMA funds in the future. When applying for mitigation funds from FEMA for acquisition projects, communities are required to submit proposed budgets, which include the estimated cost for purchasing the properties in the project from the homeowners. To derive this estimated cost, applicants generally submit the most current PVA assessment for the property. When a project is approved and funds are to be dispersed, FEMA requires that the applicant conduct an official appraisal—using a licensed appraiser—before purchasing the property. It is this appraised value, and not the assessed value, that FEMA uses as the offer price to homeowners. The data set consists of 199 properties targeted for acquisition between 1997 and 2005. The data sets include homes of various size, age, and value that are from urban, suburban, and rural areas. Although not every county is represented in the data set, all regions of the state are represented. It is possible that the

sample of homes in floodplains identified as a target for acquisition and demolition differs from homes in Kentucky otherwise, but such a difference would have to affect the relationship between assessor and appraiser behavior to affect this research.

Methodology:

The simplest statistical test to determine if the appraised values for the homes in the data set are significantly different than the assessed value is to conduct a group means comparison test. In this test, H_o is that the difference of means is zero, meaning that there is no difference between the means of the two groups. However, little analysis can be gained from this statistical test. Regression analyses are conducted using the appraised values and assessed values of the homes. In these regressions, other characteristics of the properties will be controlled to determine not only how the assessments differ from the appraisals but how they differ across areas of the state. Additionally, because certain characteristics of the homes are used to determine the value of that home a hedonic price model will be constructed using those characteristics of the properties cited by property assessors as important characteristics in their assessments.

To examine the validity of the appraised value as a measure of market value as mandated by the constitution, a regression is estimated to test whether appraised value is an unbiased estimator of the average market value of three comparable properties. To estimate the measurement error of appraised value, the variance of the three market values is calculated, subject to the hypothesis of unbiased estimation not being rejected.

All statistical tests are performed using Stata, Version 9.0

Literature Review:

Previous research on this issue has tended to focus on three main areas: the quality of assessments, the need for frequent assessments, and the quality and professionalism of assessors.

Gillen (2002) has commented on the need for quality assessments, noting that because the housing market is not as liquid as other markets it is difficult to observe actual market values. But, although the process is not an exact science, the goal of property assessors should be to avoid any systematic errors in assessments. As Strauss and Strauss (2003) note, "Where there is uniformity in assessments, our confidence in the tax collection process increases. Many would likely be willing to pay a bit more tax if they knew that greater uniformity in administration of the local real estate tax would result" (2). It could be argued that the inequity—vertical and horizontal—present in the property assessment process is responsible for the unpopularity of the property tax. After all, a homeowner is more likely to have negative views of the property tax if he believes that he has been assessed more than his neighbor who has a similar home. There is much debate as to whether the property tax is progressive (meaning that those with higher incomes pay more tax), regressive (those with lower incomes pay more tax), or proportional (all income levels pay the same percentage of their income). Demusaj (2003) notes, "Despite the fact that the property tax is a major source of revenue for many localities, ubiquitous and unequivocal consensus does not exist on the issue of whether property taxes are progressive, regressive, or proportional" (6). Though the debate is yet unsettled regarding the equity of the property tax in theory, inaccurate assessments tend to create a tax system that is skewed regressively. Gillen (2002),

Mikesell (1978), and Engle (1975) all point out that inaccuracies in the assessment process tend to create a property tax system that is regressive. Engle's (1975) argument for a *de facto* regressive property tax is that lower-income neighborhoods tend to have slow rates of increase in property values and that property assessments rarely change. But, another argument for a *de facto* regressive property tax can be made. Those with higher incomes are likely more aware of the value of not only their home but of the value of their neighbors' homes as well. Any perceived inaccuracy in a property assessment is almost certain to bring about an appeal, a process that for the assessor's office is both costly and time consuming, as mentioned by Gillen (2002).

But improprieties in the assessment—at least deliberate improprieties—may not solely be responsible for a regressive tax system. It is possible, as shown by McMillen and Weber (2006) that thin property markets may be at fault. They write, "In a slow market with few sales, relevant information cannot be incorporated quickly into either a property's market price or, by association, its assessed valuation" (3). McMillen and Weber (2006) conclude that it is strongly suggestive that thick property markets are associated with more accurate property assessments.

The frequency of property assessments is important when discussing the perceived fairness of the property tax system. As noted above, if assessments are infrequent and unchanging, those with rising property values pay proportionally less than do those living in neighborhoods with stagnant property values. But infrequent assessments also benefit infrequent movers. As stated by Strumpf (1999), "Assessed values, as well as property tax payments, are inversely proportional to home tenure" (170). Besides vertical and horizontal inequity, infrequent assessments also distort the

socially optimum tax level. Strumpf (1999) notes that long lags between property assessments lead to lower tax revenue for a community, which can only be recovered either by reassessments or a higher tax rate. Stine (2005) theorizes that rational local governments shorten this lag time between reassessments in order to generate more revenue with a lower mill rate. This is especially important in states with caps on property tax rates, such as California and Massachusetts. Stine writes, "property tax limits are intended to restrict local governments from raising local tax rates. However, the evidence from this study showed they [tax limits] were avoided…by increasing the assessment ration which usually was substantially below its legal limit" (2404). Kentucky statute requires an annual assessment, with an on-site inspection (which could be termed a reassessment) at least once within a four year period.

The accuracy of an assessment depends on two factors: the frequency by which that assessment is done and the professionalism and quality of the assessor. As Borland (1990) writes, the degree of inequity is related to "assessing procedures, neighborhood characteristics, *characteristics of the assessor and difficulty of the task*, the frequency of reassessments, and more recently, to the property tax rate itself" (431, emphasis added). It is often believed, as Bowman and Mikesell (1989) note, that the property assessment process is inherently flawed because assessors are elected rather than appointed. However, they find that in Virginia—a state that has both elected and appointed assessors—the quality of assessments does not depend on the method by which the assessor is selected. Strauss and Sullivan (1998) state that communities ought to replace appointed assessors with elected assessors if they are seeking to improve the quality of assessments. This may be surprising to some who believe that elected assessors have a

political interest in under-assessing property in their jurisdiction. Further, county assessors do a much better job than do local (i.e., city or town) assessors. Though no reason is given in the literature as to why this is true, one could suggest that a local assessor can be too involved in the day-to-day happenings of his neighbors, whereas a county assessor can be insulated politically. If, then, appointing assessors rather than electing them does not improve the quality of property assessments, what can be done to improve the quality of assessors and subsequently the quality of assessments? Bowman and Mikesell (1989) argue for contracting assessor services—presumably with certified appraisers, though they do not specify. They write, "Contracting appears empirically as well as logically, to provide professionalization's benefits without the local assessor's office being staffed by person meeting the usual professionalism standards" (186). Additionally, the state has a role to play. Strauss and Sullivan (1998) argue that state establishment and enforcement of assessment standards is necessary, which includes assessor standards. Further, prohibiting "right of entry" is related to lower quality assessments. As noted before, Kentucky statute is silent on this issue.

Analysis of Data:

A group means comparison test indicates that the mean for assessed value and the mean for appraised value are statistically different. In the data set, the mean for assessed value is $40,907 while the mean for appraised value is $58,901. As shown in Table 1, with a t-value of -5.41, the null hypothesis that the means are not different can be rejected. This is significant at the .01 level. This reveals only that the mean values of the data set are statistically significantly different. From that, we can state that the assessed value and the appraised value are different.

Table 1
Two-sample t test with equal variances

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
assedvalue	199	40906.63	2116.047	29850.51	36733.75	45079.51
appedvalue	199	58901.01	2562.828	36153.13	53847.06	63954.95
combined	398	49903.82	1719.995	34313.79	46522.38	53285.25
diff	-17994.38	3323.513			-24528.31	-11460.44

diff = mean(assedvalue) - mean(appedvalue) t = -5.4143
Ho: diff = 0 degrees of freedom = 396

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

A test of unbiased prediction of a variable y, such as assessed value, by a variable x, such as appraised value, is carried out by regressing y on x with a constant term and testing the joint hypothesis that the constant is 0 and the slope 1, i.e. that y = 0 + 1x + random variation, represented as an error term ε. The slope of unity would assure that y is just x with random noise, and the constant of 0 would assure that the level is not adjusted absolutely up or down. An F-test is used for this joint hypothesis test. The F-statistic is highly statistically significant. Below, this idea is used again to examine whether appraised values provide unbiased estimates of market values.

What happens if assessed value is regressed onto appraised value? If—and we know this is not the situation because of the group means comparison test conducted previously—assessed value and appraised value were not statistically different, then the coefficient for appraised value would be 1, indicating that the assessed value was 100 percent of the appraised value. Instead, this regression reveals a coefficient of .7558, meaning that the assessed value is 75 percent of the appraised value. In other words, if the appraised value is a proxy for the full fair market value, then assessors are under-

valuing homes by 25 percent in the data set. In addition, the estimated constant of -3612 indicates that assessed values are also adjusted absolutely downward. The hypothesis of unbiased assessment is rejected with very large F statistic ($p<0.0001$). Table 2 shows the Stata output for this regression with relevant R^2, t-values, and F-values.

Table 2
y = 0 + 1x + random variation, represented as an error term ε

Source	SS	df	MS	Number of obs = 199
				F(1, 197) = 1018.84
Model	1.4784e+11	1	1.4784e+11	Prob > F = 0.0000
Residual	2.8586e+10	197	145107824	R-squared = 0.8380
				Adj R-squared = 0.8372
Total	1.7643e+11	198	891053108	Root MSE = 12046

assedvalue	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
appedvalue	.7558242	.0236792	31.92	0.000	.7091269	.8025214
cons	-3612.175	1635.375	-2.21	0.028	-6837.264	-387.0858

This regression can be expanded further, controlling for both urban and rural areas. Rural areas are defined as cities with populations less than 20,000, while urban areas are considered cities with populations greater than 20,000. In this regression, the coefficient for appraised value becomes .7570. Again, urban areas in the data set assess their properties at 75 percent of the fair market value. However, rural areas do not do so well in assessing properties at their market value. When only rural properties are regressed, the coefficient for appraised value is .6987; rural PVAs assess properties approximately 30 percent below their fair market value. Tables 3 and 4 show the relevant Stata output. The constant terms are statistically insignificant in these regressions, indicating the statistically significant constant in the combined regression could have resulted from combining the samples, not from appraiser practice. Both urban and rural assessors appear to scale down appraised values, but at different average rates.

Table 3
y = 0 + 1x + random variation, represented as an error term ε if urban =1

Source	SS	df	MS	Number of obs =	87
				F(1, 85) =	503.11
Model	7.7622e+10	1	7.7622e+10	Prob > F =	0.0000
Residual|	1.3114e+10	85	154286645	R-squared =	0.8555
				Adj R-squared =	0.8538
Total	9.0737e+10	86	1.0551e+09	Root MSE =	12421

assedvalue	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
appedvalue	.7569824	.0337486	22.43	0.000	.6898811	.8240837
cons	-2428.157	2944.878	-0.82	0.412	-8283.362	3427.049

Table 4
y = 0 + 1x + random variation, represented as an error term ε if urban =0

Source	SS	df	MS	Number of obs =	112
				F(1, 110) =	243.30
Model	3.3174e+10	1	3.3174e+10	Prob > F =	0.0000
Residual	1.4999e+10	110	136351710	R-squared =	0.6886
				Adj R-squared =	0.6858
Total	4.8173e+10	111	433987717	Root MSE =	11677

assedvalue	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
appedvalue	.698664	.044792	15.60	0.000	.6098968	.7874311
cons	-2075.494	2266.472	-0.92	0.362	-6567.109	2416.121

In the above tests, urban areas and rural areas were analyzed separately. Similar conclusions can be reached by using all observations and including a dummy variable "urban" along with an interaction variable uapped (urban times appraised value). The variable "urban" is a dummy variable with "1" representing an urban location and "0" representing a rural location. The interaction variable represents appraisals in urban areas. In the regression model, we have $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon$, where x_1 = the appraised value of the home, x_2 = the dummy variable "urban" with "urban" =1 if in an

urban location, and x_3 = the interaction variable "uapped" indicating the appraisal of a home in an urban area. Table 5 contains the relevant Stata output for this model. In the model, we have significant coefficients on the variables "appedvalue" and "uapped." Those coefficients are .6469 and .1101, respectively, indicating that a home is assessed at approximately 65 percent of its fair market value with an urban assessment being worth an additional 11 percent. This is similar to what was found earlier using only urban areas in the regression; in that model, the estimated coefficient was .7570. Again, urban assessments are much closer to revealing the true fair market value of a home than are assessments conducted in rural areas of the Commonwealth.

Table 5
$\mathbf{y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon}$

Source	SS	df	MS	Number of obs = 199
				F(3, 197) = 371.18
Model	1.5259e+11	3	5.0862e+10	Prob > F = 0.0000
Residual	2.6995e+10	197	137029576	R-squared = 0.8497
				Adj R-squared = 0.8474
Total	1.7958e+11	200	897909505	Root MSE = 11706

assedvalue	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
appedvalue	.6468708	.0400143	16.17	0.000	.5679595	.7257821
urban	-2081.429	3471.045	-0.60	0.549	-8926.605	4763.747
uapped	.1101115	.0511147	2.15	0.032	.0093092	.2109139
cons	-346.7279	2084.672	-0.17	0.868	-4457.865	3764.41

Assessors—and appraisers—indicate that certain characteristics of the home are important when estimating the market value of a home. Indeed, as previously mentioned, characteristics such as the size of the home (as measured by square feet), the number of bathrooms and bedrooms, and the age of the home are the primary characteristics analyzed when determining a home's worth. Thus, we can estimate the value of the

properties in the data set using a hedonic price model and regressing assessed value on those characteristics known to be important to property assessors. The model becomes $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_4 x_4 + \varepsilon$, with x_1 = the variable "sqft" representing the size of the house measure by square feet; x_2 = the variable "bedrooms" representing the number of bedrooms in the home; x_3 = the variable "bathrooms" indicating the number of bathrooms in the home; and x_4 = the variable "age" for the age of the home. The "y" variable is assessed value. The model indicates that of those four variables, only bedrooms in not a significant coefficient. Table 6 details the relevant Stata output. As we can see, on average each additional square foot of living space adds an additional $17.53 to the value of a home. Further, each additional bathroom is worth an additional $11,197. That this variable is statistically significant and the variable "bedrooms" is not statistically significant is not surprising. The coefficient for "age" is negative, which is also not surprising. Though there may be value in historic neighborhoods and older homes, there is the possibility that older homes are in stagnant and deteriorating neighborhoods, which would lower the value of the home.

Table 6
$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon$

Source	SS	df	MS	Number of obs = 199
				F(4, 194) = 13.81
Model	3.9094e+10	4	9.7735e+09	Prob > F = 0.0000
Residual	1.3733e+11	194	707910066	R-squared = 0.2216
				Adj R-squared = 0.2055
Total	1.7643e+11	198	891053108	Root MSE = 26607

assedvalue	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sqft	17.53325	6.475086	2.71	0.007	4.762645	30.30385
bedrooms	2068.238	2921.197	0.71	0.480	-3693.143	7829.62
bathrooms	11196.52	5113.417	2.19	0.030	1111.491	21281.55
age	-274.9943	106.1173	-2.59	0.010	-484.286	-65.70249
cons	9241.42	8811.886	1.05	0.296	-8137.976	26620.82

The hedonic model estimates what determines the market value of a house. Inserting into the same hedonic model the variable appedvalue (appraised value) tests a different hypothesis. If assessed values are scaled versions of appraised values, then conditional on appraised value, characteristics of homes should not matter. If assessors, in contrast, value specific features of homes differently from the market, then those features predict differences between assessed and appraised values. If the coefficient for appraised value is not capturing assessor behavior toward those home characteristics, then the coefficients for "sqft", "bedrooms", "bathrooms", and "age" should remain significant. As shown in Table 7, when regressing assessed value onto the home characteristic variables and the appraised value of the home, the only coefficient that is significant is the one associated with the appraised value of the home; the others are individually and jointly statistically insignificant. This implies that assessors scale down the market value on average without adjusting for specific characteristics.

Table 7

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon$$

Source	SS	df	MS	Number of obs = 199
				F(5, 193) = 202.11
Model	1.4814e+11	5	2.9627e+10	Prob > F = 0.0000
Residual	2.8292e+10	193	146588429	R-squared = 0.8396
				Adj R-squared = 0.8355
Total	1.7643e+11	198	891053108	Root MSE = 12107

assedvalue	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sqft	-.4178954	3.019115	-0.14	0.890	-6.372591	5.536801
bedrooms	386.0561	1330.726	0.29	0.772	-2238.577	3010.689
bathrooms	-1277.407	2371.391	-0.54	0.591	-5954.577	3399.763
age	58.92013	49.81672	1.18	0.238	-39.33497	157.1752
appedvalue	.7709786	.0282679	27.27	0.000	.715225	.8267323
cons	-5683.476	4047.031	-1.40	0.162	-13665.56	2298.612

We can expand these models further by including dummy variables for the different foundations of the homes in the data set—poured concrete, mobile home, or another foundation type. Adding the dummy variables for foundation types does not change the significance of the other variables—size of the home, age, and number of bathroom remain statistically significant. However, only "mobile" is significant of the foundation-type variables. A mobile home reduces the hedonic value of a property assessment by approximately $33,632.42. However, there is no change to the conclusion that assessors scale down the market value with no reference to specific characteristics, including foundation and mobile home.

All of this presumes that appraised value is in fact a valid measure of fair market value. If it is not, none of the conclusions are useful, and if it is measured with error, then the coefficients on it are biased toward zero, biasing such estimates as the 75 percent ratio of assessed to appraised value toward zero, making interpretation of assessor behavior impossible.

To evaluate the appraised value directly, the average market value of three comparable properties is regressed on appraised value. This expected value model is similar to the one above where assessed value was regressed on appraised value. As before, a constant of zero and a slope of unity subject to sampling error is the relevant joint hypothesis. Table 8 shows the relevant Stata output. The estimates show a constant of 2337 (t-value of 0.72) and a slope of 0.9825 (standard error of 0.0472), both individually and jointly insignificantly different from the hypothetical values ($p<0.69$). So the appraised value appears to be an unbiased estimator of the market value of comparable properties.

Table 8
y = 0 + 1x + random variation, represented as an error term ε

Source	SS	df	MS	Number of obs =	199
				F(1, 197) =	433.25
Model	2.4981e+11	1	2.4981e+11	Prob > F =	0.0000
Residual	1.1359e+11	197	576605081	R-squared =	0.6874
				Adj R-squared =	0.6858
Total	3.6340e+11	198	1.8354e+09	Root MSE =	24013

avgappval	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
appedvalue	.9824927	.047202	20.81	0.000	.8894066	1.075579
cons	2337.457	3259.952	0.72	0.474	-4091.426	8766.34

It is still possible that there could be measurement error, but that can be measured directly using the three comparable properties. The standard deviation of appraised values is 36153. The average standard deviation of measurement error across these 199 properties is 6897, less than one fifth of 36153. The variance of measurement error is the square of the ratio of standard deviations, 3.5 percent of the variance of appraised values. This implies that the downward bias in regression-estimated relationship between assessed and appraised values is similar, 3.5 percent. For example, a coefficient of 0.7 might have been 0.7245 (i.e. 0.7 times 1.035) without any measurement error. Such a small measurement error changes no qualitative conclusions or comparisons in this paper. Appraised value is an appropriate standard against which to compare assessed value.

Conclusion:

Based on the data set available, it appears as though property assessors throughout Kentucky are under-assessing residential property, on average, by approximately 25 percent. The Kentucky State Constitution, as well as KRS 132.690 explicitly state that all real property must be assessed at 100 percent of its fair market value, which in this

data set is represented by the appraisal value. Various econometric tests confirm that this value is, indeed, a good measure of the fair market value. Therefore, the properties in the data set—at the time of their assessment—were not assessed at their full fair market value, in violation of the law. Additionally, econometrical testing indicates that properties in rural areas are assessed at a much lower rate (69 percent of fair market value) than the entire data set while urban properties are assessed at a higher rate (approximately 78 percent of fair market value).

Based on available evidence, it also appears as though the assessors in this data set are aware of the fair market value and are scaling back the assessments, as indicated by a hedonic price model constructed with relevant property characteristics used by property assessors to assess residential property.

It is possible to theorize why the data indicates the results above. First, it is important to note that property assessment is not an exact science, especially in thin markets with little available comparison data. This is a possible explanation for the difference is assessment quality between rural and urban areas. But assessor quality is also a potential factor. It is the belief of at least one Kentucky PVA that many PVAs throughout the state are not qualified and lack the necessary skills to accurately value properties. Whether this is true or not is not known, but it is probable that PVA offices in more populated areas have larger staffs and budgets. If money, or a lack thereof, is correlated with assessment quality it is likely that this perception is only seemingly true because larger offices can afford better training for the assessors. One possible solution that has potential for success is to supplement PVA assessments with private appraisals, an approach argued by Bowman and Mikesell (1989). This could help alleviate the

difficulty with not only thin markets but may increase the perception of professionalism in some PVA offices. It should be noted that because not all Kentucky counties are represented in this data set and because this data set includes properties which may or may not be representative of the housing population throughout the Commonwealth, more study is indeed needed on this issue.

It is, however, troubling that the data does indicate some assessor knowledge of the full fair market value. It makes one wonder if assessors are not scaling back assessments in order to avoid the costly and time consuming appeals process, seemingly knowing that assessing at 75 percent of market value is the limit beyond which property owners are more likely to appeal. It is also possible, though great care has been taken to avoid much discussion of politics in this study, that assessors are worried about their re-electability. Kentucky PVAs are elected in each county; it is within the realm of possibility that under-assessment occurs not only to avoid the costly appeals process but that by avoiding the appeals process the electorate is not dissatisfied with the job performance of the PVA. However, it is difficult to know how much, if any, politics influences the property assessment process. Again, more study of this issue is necessary.

Inaccurate property assessments can distort the property tax system, creating inequities both horizontally and vertically. Horizontal inequity is created if two similar properties are assessed at a different value. Vertical inequity is created if the assessments are under-assessed more for higher income properties than for lower income properties. A property tax system that is perceived as being fair and equitable is necessary for the function of local governments. A property assessment process that values properties at their full fair market value is the basis for this property tax system. Though current

evidence indicates that assessors are not valuing property at 100 percent of their fair market value, as required by law, is it important to mention that in 1965 the Kentucky Court of Appeals found that properties were, on average, being assessed between 12.5 percent and 33 percent of their fair market value. Though the evidence indicates that assessment quality is improving, there also remains room for further improvement.

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Appendix 1:
Proposed budget submitted by Lexington-Fayette Urban County Government for a FEMA grant project in 1998 to buy floodprone homes. Note the columns indicating PVA assessment value and the 20 percent multiplier to bring the value up to fair market value.

Budget
Lexington-Fayette Urban County Government Flood Mitigation Project Phase II

Item	PVA Assessment	20%*	10%**	Fair Market Value	Asbestos/Lead Testing	Estimated Cost for Demolition	Estimated Appraisal Cost	Estimated Closing Cost	Rental Relocation Assistance	Engineering Study	Total Cost
Purchase 1108 Kilrush Drive	$89,500.00	$17,900.00		$107,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$10,500.00	$2,058.82	$131,958.82
Purchase 1111 Kilrush Drive	$89,500.00	$17,900.00		$107,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$10,500.00	$2,058.82	$131,958.82
Purchase 1115 Kilrush Drive	$87,000.00	$17,400.00		$104,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$10,500.00	$2,058.82	$128,958.82
Purchase 1119 Kilrush Drive	$89,500.00	$17,900.00		$107,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$10,500.00	$2,058.82	$131,958.82
Purchase 1123 Kilrush Drive	$85,500.00	$17,100.00		$102,600.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$116,658.82
Purchase 1127 Kilrush Drive	$72,500.00	$14,500.00		$87,000.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$101,058.82
Purchase 1131 Kilrush Drive	$77,000.00	$15,400.00		$92,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$106,458.82
Purchase 1135 Kilrush Drive	$79,500.00	$15,900.00		$95,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$109,458.82
Purchase 1139 Kilrush Drive	$77,000.00	$15,400.00		$92,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$106,458.82
Purchase 1143 Kilrush Drive	$77,000.00	$15,400.00		$92,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$106,458.82
Purchase 1147 Kilrush Drive	$84,500.00	$16,900.00		$101,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$115,458.82
Purchase 1151 Kilrush Drive	$87,000.00	$17,400.00		$104,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$118,458.82
Purchase 1155 Kilrush Drive	$88,500.00	$17,700.00		$106,200.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$120,258.82
Purchase 1159 Kilrush Drive	$82,000.00	$16,400.00		$98,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$112,458.82
Purchase 1163 Kilrush Drive	$77,000.00	$15,400.00		$92,400.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$106,458.82
Purchase 1167 Kilrush Drive	$82,900.00	$16,580.00	$8,290.00	$107,770.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$121,828.82
Purchase 1171 Kilrush Drive	$75,000.00	$15,000.00		$90,000.00	$100.00	$10,500.00	$400.00	$1,000.00	$0.00	$2,058.82	$104,058.82
Total	$1,400,900.00	$280,180.00	$8,290.00	$1,689,370.00	$1,700.00	$178,500.00	$6,800.00	$17,000.00	$42,000.00	$35,000.00	**$1,970,370.00**

* Takes the PVA Assessed value of the property up to an estimated fair market value.
** Handicapped accessible house.

Attachment to Page 7 of HMGP Application
budgetattachment12-21-00.xls

12/22/2000