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Is There Assessor Bias in the Real Estate Market?

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Research Honors Project, Spring 2004

The purpose of this paper is to determine if the valuation of property adheres to the 33 1/3 proportion of market value required by the state of Illinois or if assessors are over-valuing Bloomington real estate disproportionately across high and low income neighborhoods. Assessors have a motivation to over-value high-income properties disproportionately resulting in intentional and systematic bias which alters the property tax system. The results do not support this idea. They show a lower percent variation between assessed and market values in high-income households.

I. Introduction

Taxation creates income for governments to operate effectively and according to public sentiment. Taxes can be an important policy tool to meet community goals. They can be used to limit size or sprawl of a city, to protect the environment, or to encourage local ownership and production (ILSR 2003). The property tax is one component of a taxpayer's contribution to the government and it is the largest single tax in Illinois (IDR 2002). These taxes are levied on the local level in Illinois, which includes counties, townships, municipalities, school districts, special districts, etc. The total rate of property tax in the city of Bloomington, which includes all levels of taxation, was 7.4244% per \$100 assessed value in 2000 (DCEO 2003).

Local assessing officials make assessments of the property in their locality. The value placed on the property should be $33 \frac{1}{3}$ percent of the market value (IDR 2002). However, market value can fluctuate dramatically depending on the area and the associated externalities. The purpose of this paper is to determine if the valuation of the property adheres to the $33 \frac{1}{3}$ proportion or if assessors are over-valuing real estate disproportionately across high and low income neighborhoods. It is important that assessors conduct an accurate and fair assessment because of the *ad valorem* tax consequences associated with real estate taxes. The *ad valorem* property tax is effectively a flat tax because it is assessed at the same rate over the entire community. If the assessments are not accurate and fair, then those homeowners that experience disproportionate over valuation will end up with a higher tax bill. According to the model presented by Tiebout (1956) and modified by Hamilton (1975) to include property

tax, these homeowners will then decide to stay where they are or to create a new municipality where they will be assessed equally across the community. This decision gives the taxpayers in high-income neighborhoods the power to change the system if necessary. If households start moving out of the area to go to a better property tax environment then the city of Bloomington will lose revenue, so it is imperative that assessors in this community maintain the equality of the property tax system that is required by the Illinois Department of Revenue.

According to Thibodeau (2003), property assessors make an estimate of property value subject to property information and comparable property sales. These assessments should be made accurately and this accuracy is empirically related to the size and age of the properties in a certain neighborhood (Thibodeau 2003). Assessors may assess property in certain neighborhoods less accurately or disproportionately higher than in other neighborhoods because of the type of properties included in that area. Different areas contain characteristics that affect the assessments of properties. Characteristics include the income of the households in the area, the age of the house, the school system, parks, proximity of shopping areas, and the state of the real estate market at a point in time.

Assessment values change to reflect the changes in the market value of property. However, there can be both individual changes in value that represent noise in the assessment or actual market prescribed changes in value. Demand side factors can alter the market value of property. There are numerous factors that can shift the price of property. If buyers are looking for a certain type of house, then they may be willing to pay a higher price, creating individual noise that alters the market determined price. On

the other hand, a prospective homeowner could settle on any house causing the price to follow the prescribed market curves with very little individual noise. Market value may also fluctuate according to seasonal demand.

Since there are many factors that control for the market value of property, assessing officials can easily show bias in their assessments. Bias is defined as a systematic and knowledgeable alteration of data; in contrast, error is an unintentional alteration or a mistake. Market values shift regularly and assessors must extract the true value from the market noise (Geltner 2003). The extraction process is known as appraisal smoothing, or appraisal lag. There are many ways to make a mistake or misinterpret information, which may lead to an opening for intentional biases. Because of this appraisal smoothing, assessing officials may include bias in their assessment of higher income neighborhoods by disproportionately overestimating the true market value when compared to other neighborhoods, therefore, creating inequity in property assessments across different neighborhoods. There may be an unequal upward bias because of the greater ability of high-income homeowners to pay an increased *ad valorem* tax liability. The motivation behind the upward bias in assessments is to extract greater tax revenues from the high-income community while maintaining the current tax rate on the surface. When assessments are high, this can become a tax burden on households that own expensive single-family homes. This is an important issue because if there is an unequal bias depending on the neighborhood each taxpayer lives in, then the property tax becomes more of a progressive tax, rather than a flat tax across all homeowners. The current system determined by the Illinois Department of Revenue

requires a flat tax, assessed at the same rate across all property, and assessors may be improperly altering that system by disproportionately biasing real estate assessments.

In this paper, I will explore bias and determine if there is a consistent, disproportionate over valuation in high income property assessments provided by the Bloomington Assessors' Office when compared to the selling prices of the same houses, which were sold in 2003. According to the Bloomington Assessors' office, all property valuations are to be estimated equitably across similar properties (AOBT 2003). The assessors take into account property characteristics along with the state of the real estate market when they value each property.

The following section will give an overview of past studies in real estate valuation and show how my research follows. Section three will describe the theoretical model along with the empirical model. Section four will describe the type of data to be used in this study and where it can be found. The results of the regression will be described in section five. Then the conclusion and policy implications will follow in section six.

II. Review of the Literature

Previous research shows that externalities can cause variations in property valuation. McCluskey and Rausser (2003) explore the influence of environmental hazards as detrimental to property valuations. They found that property close to an environmental hazard would have a lower valuation even after the hazard has been cleaned up. The perceived risk that continues to accompany the surrounding property will lower valuation, both assessed and market, even though that risk may or may not have a scientific foundation. There is also an intangible element in real estate that is

determined by the perception of the public. For example, when a neighborhood is no longer perceived as fashionable, the value of the property decreases (McCluskey 2003). This intangible component may allow assessors to intentionally add bias into their assessments because the intangible component cannot be reliably measured until the actual sale of the property.

Appraisers are, to some extent, the private real estate market analogue of stock analysts in the stock market (Geltner 2003). These appraisers take into account fundamental variables, such as square footage and age, and extraneous variables, such as real estate market information, to make their assessments of market value. Through this work, the assessors are involved in an important way in interpreting information that may have an influence on price (Geltner 2003). One of the exogenous variables that assessors look at is the liquidity of the real estate market, which is a measure of how the market is doing at that point in time. Geltner (2003) defines liquidity as the volume of trading in the asset market. In the real estate market, liquidity is the rate at which houses sell once they are placed on the market. This overall market proxy is good to determine the state of the entire market. However, individual properties may go against the flow of the market, either selling more quickly or remaining on the market longer.

In determining individual valuation, Quan and Quigley (1991) set forth a fundamental model that can be characterized as one in which market value changes according to a random walk and observed prices consist of the market value plus a cross-sectionally dispersed random noise, meaning the volatility caused by exogenous market movements, components that exist only when and if a transaction occurs. Such noise can be caused by individual property preferences of a single buyer, meaning that certain

characteristics may be valued higher by an individual than the market and this variation is noise. Property valuation must take into account and disregard the underlying noise involved in the initial transaction, buying the house, and also random variances that accumulate in the true valuation from the point of the last transaction. Any of this noise can create an opportunity for the assessor to over value property, such as, purposefully reading the noise variation as a permanent change in market value, therefore, creating a bias in certain assessments.

Interest in the statistical estimation of house prices has recently shifted from the academic community to commerce. Several companies are developing automated valuation models (AVMs) that have the ability to estimate the value of any single-family home in the United States in real time and at a fraction of the cost of traditional appraisals (Thibodeau 2003). However, these AVMs are not perfect substitutes for traditional appraisals. The valuation created through the use of an AVM is simply an estimate of the property value given subject property information and comparable property sales. The traditional assessor provides an assessment of the value, but also personally inspects the property to verify that the information used to value the property is accurate. This personal inspection can also lessen the objectivity that can be obtained through an automated system.

In further research into the automated valuation models, Thibodeau (2003) found that valuation accuracy is related to several factors. This accuracy is empirically related to the size and age of the properties in a certain neighborhood, to the heterogeneity of properties in the neighborhood, and to the rate of turnover in the local housing stock. In

my model I will follow part of Thibodeau's research. The size and age of the property will relate to the accuracy of the assessed valuation.

III. Theoretical and Empirical Model

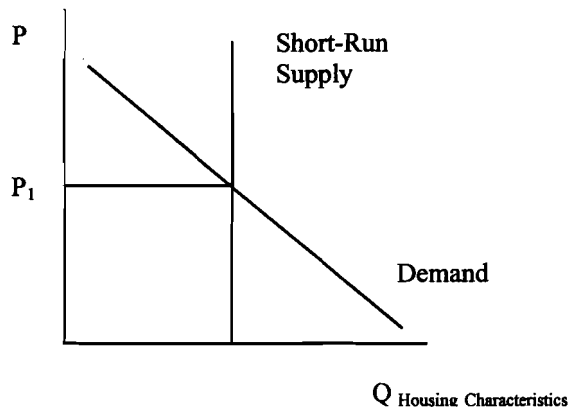
The Hedonic pricing model is based on the concept that a house buyer purchases both a dwelling and a set of site characteristics (O'Sullivan 2000). Housing is consumed along with other attributes such as facilities, tax liabilities, public services, environmental quality, and neighborhood characteristics. The price of housing is then found by adding the value of each component.

To arrive at the valuation, the model looks at the various inputs that go into the product. Each additional unit of input should change the value of the property. In this study each property should be assessed as a function of inputs that will include both property characteristics and external characteristics in the context of a supply and demand function. This assessment should be 33 1/3% of the actual market value. Any deviation from this proportion represents either error or intentional bias on the part of the assessor. The main focus of this paper is to identify the bias that may exist between valuation and the property belonging to a high-income neighborhood. If the deviation is spread over various neighborhoods and not focused on high-income property owners, then the deviation is more likely due to error. However, if the deviation is consistently higher in high-income neighborhoods this represents bias.

Each characteristic included in this model can be classified as a demand side factor. As these characteristics change they will cause shifts in the demand curve. The

intersection of the demand curve with a short run, or fixed, supply curve will coincide with the market price of the property, as demonstrated in Figure 1.

Figure 1 Supply and Demand Curves



The variation analysis is accomplished empirically using an ordinary least squares regression analysis. The following mathematical model demonstrates the function to be used to determine the variation in the 33 1/3% relationship between market value and assessment value.

$$\text{VARIATION} = \beta_0 + \beta_1 \text{SQFT} + \beta_2 \text{AGE} + \beta_3 \text{SEASONVAR} + \beta_4 \text{HIGHINCOME}$$

The dependant variation is defined as the percentage difference between assessed value and market value calculated as the difference between three times the assessed value and market value divided by the market value. As the officials assess each property every effort is made to ensure that each assessment is comparable to similar properties. However, there are externalities that can create a deviation from the 33 1/3% proportion.

The following four variables are used as a control to demonstrate similar properties, and the last variable, HIGHINCOME, will be the main focus.

Total square footage of each individual house is a fundamental property characteristic. The square footage (SQFT) is measured as the floor space of all levels of the home. This characteristic is a demand-side factor, because everything else equal buyers want greater square footage. Each individual buyer has space requirements that go into searching for a house. More expensive homes are usually larger than average priced houses. More square footage allows for excess space and room for more bedrooms and baths, which will increase value shown by shifting the demand curve to the right. As the size of the home increases, then the market value of the home should also increase. This variable will determine the variation between assessed value and market value that is contributed by the size of the house and the sign is ambiguous because it depends on which valuation method, market or assessment, picks up the differences in square footage more readily, or it could have no effect if both market value and assessed value capture this attribute equally accurately.

As a house gets older there are various factors that affect the value of the home. The age of the house, measured by the variable AGE, is determined by the number of years since it was constructed. As a house ages there is unavoidable wear and tear on the house and this can result in a depreciation of value. However, there are also positive factors that can affect value. Improvements that have been undertaken by the current owners can increase the value because they have altered the original property. Also, there are neighborhood characteristics that can increase or decrease property value, such as improved landscaping, the addition of shopping amenities, changes in school facilities,

or changes in traffic patterns in the area. AGE can be either positively or negatively correlated with the variation in the assessed value of the property when compared to the market price. This correlation can be seen as either a right or left shift of the demand curve, respectively. Each individual house will have a unique way of aging and its effect on market value is hard to predict with great accuracy. Its sign in the estimating equation depends again on the market effect relative to the effect in assessed valuation

There are also external factors that affect the valuation of property. The overall state of the market is a proxy that determines if the market is high or low. The determination of high or low is made through several characteristics, such as the number of houses that are being bought at a certain time or the fluctuation in prices of certain properties over time and through seasonal variations. This is important because the market determines the prices of real estate. If the market is low then the market value will also be low and the opposite is true, if the market is high then the value of property will also be higher. However, this variable has a high potential for noise, which was described earlier in the Quan and Quigley (1991) model of individual asset pricing. When the liquidity of property is high, then the market value is most likely low because houses sell faster, which means that homeowners are desperate to sell and will accept a lower price. Sellers are the ones that post the initial listing price according to the market in a certain time period and buyers usually shop according to list price (USHUD 2003). This variable is hard to predict because the market price and assessment value may move together as the market conditions change. Therefore, the proportion of the variation between the two values would remain unchanged. However, the market conditions change frequently and the assessed value will not be able to move with the constant

changes whereas the sale price will change instantaneously with the market. In this case, a high percentage of transactions would narrow the difference between market value and assessed value. This leads to an ambiguity arising from the number of houses demanded or the number of houses on the market at a given time.

The variables listed above are the control variables for the variation function I have developed for this study. They control for the normal inputs that an assessor usually takes into account when making an assessment. Similar houses should be assessed equally according to the City of Bloomington Assessors' Office. The last variable I included is the variable for neighborhood classification. It is my hypothesis that assessors are biased according to the neighborhood that a property is a part of and they will artificially increase the assessed value in comparison with the market value in a high-income area. It is my assertion that assessors overvalue high-income housing more consistently than low income housing to relieve the tax burden on other parts of the community. HIGHINCOME will be the percent of households in a certain census tract and block group that are considered to be high-income households. As the percentage increases the neighborhood is considered to be increasingly high income. This variable will have a positive relationship with the dependent variable, VARIATION. As the percentage of high-income households in a block group increases, there will be more variation between market value and assessed value.

Table 1 summarizes the expected signs of each of the independent variables used in this study.

Table 1	Expected Sign of Each of the Variables	
<i>Variable</i>	<i>Expected Sign</i>	
Dependent	VARIATION	
Independent	SQFT	+/-
	AGE	+/-
	SEASONVAR	+/-
	HIGHINCOME	+

IV. Data

This study uses data from the city of Bloomington, Illinois. The cases include a sample of 120 randomly selected single-family homes that were bought in 2003. Ten properties were chosen from one week in each month, the first week in January, the second week in February, the third week in March and so on. The main sources of these data are the Bloomington Assessors Office, the McLean County Records Office, and the Bloomington Community Development Office. These sources will provide all of the valuations, both market and assessment, for my sample, along with the independent variables. Table 2 contains the variable definitions, information on how the variables are measured and the source of the data.

Table 2	Variable Definitions and Data Sources			
Variable	Definition	Measured By	Unit	Data Source
VARIATION	Assess minus Market over Market	Local assessing official estimate of value and market value	Percent	Bloomington Assessors' Office McLean County Records Office
SQFT	Square footage of the home	Actual square footage	Square Feet	Bloomington Assessors' Office

AGE	Years since built	Year built	Years	Bloomington Assessors' Office
SEASON VAR	The state of market in month property was bought	Real Estate Sales rate	Sales per Month/Total Sales per Year	McLean County Recorders Office
HIGH INCOME	Percentage of households considered high income	Census Data	Percent	Bloomington Community Development Office

Table 3 Descriptive Statistics for Regression 1				
Variable	Mean	Minimum	Maximum	Std. Dev.
VARIATION	-10.07%	-93.66%	57.83%	21.28
SQFT	1820.46	592.00	4803.00	837.07
AGE	16.94	.00	139.00	19.37
SEASOVAR	8.33%	5.68%	11.97%	1.92
HIGHINCOME	68.17%	15.60%	100.00%	22.99

V. Results

The results discussed in the next section demonstrate there is not bias in the real estate market. The correct assessment value is obtained by dividing the market value by three to acquire the 33 1/3 proportion required by the state of Illinois. The assessments in this study do not show a disproportionate upward bias in higher income areas.

The results in Table 4 demonstrate the relationship between each of the independent variables and the dependent variable, percent difference between assessed value and market value. The regression includes a data set of 120 single-family homes in the Bloomington area. This regression yields an adjusted R^2 of .055. This demonstrates

that 5.5% of the variation in the dependent variable is explained by the independent variables.

Table 4 Regression 1 Results (Dependent Variable =VARIATION)		
Variable	Coefficients	Significance
SQFT	-.004048 (-1.460)	.147
AGE	-.103 (-.862)	.391
SEASONVAR	-1.42 (-1.350)	.180
HIGHINCOME	-.141 (-1.238)	.218
F-Statistic	2.736	
Adj. R ²	.055	
N	120	
t-Statistics in parentheses		

I hypothesized that square footage could have either a positive or negative effect on the variation between market and assessed value. The individual demand for square footage is the determining factor in the sign of this variable. If an individual buyer perceives square footage as an important characteristic when making the decision to buy a house, then that individual will be more willing to pay a higher price than what the market prescribes. On the other hand, if square footage is not an important factor to a buyer then they will pay closer to the prescribed market value of the home, everything else being equal. The regression shows that square footage increases variation, however, very slightly. As square footage increases by one the percent variation between assessed value and market value decreases by 0.4%. This result shows that individual buyers value square footage equally with the market because the differences between assessed value and market value are low and the significance of this variable is at the 14.7% level, which means that SQFT is not a very significant variable.

The age variable was also hard to hypothesize. The age variable could have been either positive or negative. There is overall depreciation of the house itself, which causes a decrease in assessed value and market value. All property loses value over its life because of normal wear and tear that occurs due to weather and overall usage from the occupants. However, there can be increases in value due to improvements made by the owners as they live in the house. Improvements include remodeling the interior and also exterior additions to the house. In this model the coefficient of the age variable is negative. This means that as the property in this data set ages one additional year its value variation decreases. However this variable is small and insignificant, which means that the market and individual buyers value age about equally.

The seasonal variation variable could have been either positive or negative because of the noise associated with the market fluctuations. The market and assessed values should move together as the market conditions change, however, the assessed values cannot change instantaneously as conditions change so the variation can increase or decrease depending on the direction of the market tide because only market value will reflect this noise. The results show that as SEASONVAR increases by 1% the variation decreases by 1.41%, which shows that, most likely, market values increased as the percent of transactions relative to normal decreased.

I hypothesized that the high-income variable would be positive. Assessors are biased according to the area that a property resides in. High-income neighborhoods are more likely to have disproportionately over assessed property. High-income families are able to pay the additional taxes that accompany higher valued real estate, so assessors have an incentive to exploit that ability to reduce the tax liability on homeowners that are

less able to pay additional taxes. The regression performed on this data set does not support my theory. The coefficient of HIGHINCOME is negative. This shows that if a house is in an area that has a higher percent of high-income households in this study that the variation between assessment and market values decreases independent of the other variables. The variation decreases by .141% as the percent of high-income households in an area increases by 1%. This variable is the opposite sign than what was predicted, however, it is insignificant and there is ambiguity in the interpretation of the coefficient. The ambiguity arises from the movement of the assessed and market values; either the assessed value is falling or the market value is rising as HIGHINCOME increases.

By running a second regression the ambiguity of the HIGHINCOME variable can be lessened. The following mathematical model will show how the market values relate to the assessed values of properties.

$$\text{ASSESSX3} = \beta_0 + \beta_1\text{SALEPRICE} + \beta_2\text{SEASONVAR} + \beta_3\text{HIGHINCOME}$$

The coefficient of SALEPRICE should be significantly greater than one if the assessed value is biased upward for high-income properties and is the dominating variable in VARIATION from the first regression. The descriptive statistics for the variables used in the second regression are shown in Table 5. The results of this regression are shown in Table 6.

Table 5 Descriptive Statistics for Regression 2				
Variable	Mean	Minimum	Maximum	Std. Dev.
ASSESSX3	\$142822.80	\$36720.00	\$559410.00	86007.95
SALEPRICE	\$167165.52	\$35805.00	\$663896.00	100672.50
SEASONVAR	8.33%	5.68%	11.97%	1.92
HIGHINCOME	68.17%	15.60%	100.00%	22.99

Table 6 Regression 2 Results (Dependent Variable = ASSESSX3)		
Variables	Coefficients	Significance
SALESPRICE	.590* (9.223)	.000
SEASONVAR	-683.043 (-.247)	.805
HIGHINCOME	412.204 (1.467)	.145
F-Statistic	52.113	
Adj. R ²	.563	
N	120	

t-Statistic in parentheses

* indicates significance of .000

The results for this regression show that SALESPRICE is the dominant value in the percent variation calculation used in the first regression. This means that as SALESPRICE goes up by \$1 the assessed value will go up by \$0.59.

This regression shows that HIGHINCOME does increase the three times the assessment value by \$412.20 as the percent of high-income households in an area increases by 1%. This increase may reflect individual assessments or the status of the neighborhood a property belongs to. The status of the neighborhood could be determined by the additional externalities associated with a high-income area and these could increase the assessment rather than the actual property characteristics. However, this result does not explain the increase in assessed value in high-income neighborhoods significantly and, therefore, does not support the hypothesis.

VI. Conclusion

Taxes are a vital part of the government's revenue system. It allows the government to operate effectively and it is an important policy tool to meet community goals. In Illinois, the property tax is the largest single tax, equaling 7.4244% per \$100 assessed. Assessors have an incentive to disproportionately over value high-income property because it raises tax revenues within the flat tax structure as it eases the tax burden of less advantaged parts of the community. However, evidence to support this hypothesis could not be found. The first regression in this study resulted in a negative sign for the HIGHINCOME variable when it was hypothesized as having a positive sign in relationship to the variation between assessed value and market value. There is some ambiguity in this result due to the possibility of movement in either the assessed value or the market value. The second regression resolved this ambiguity by demonstrating that a change of \$1 in the sales price will result in a change of \$.59 in assessed values, which means that market value is the dominant value in the variation calculation.

The low adjusted R^2 in regression 1 may suggest that there are variables left out of this regression. It is also consistent with variation being random. The percent of the variation explained in the dependent variable needs to be increased by adding more significant variables. Other neighborhood characteristics could be added because the individual demand for housing depends on the surrounding areas in a neighborhood in addition to the variables already included in this study. Other characteristics include the quality of the school system in an area, or the proximity of shopping areas, the proximity of parks and other recreation areas, the make up of the household's family structure, and a variety of others. These additional characteristics change the individual demand curve

of buyers and will alter the market price while the assessed value will stay the same.

However, these data are hard to obtain because of the difficulty and inaccuracy in measurement and therefore are not included in this study. Another way to improve this study is to increase the sample size by including all houses sold in a certain year or expanding the sale years to get a better feel for market trends.

For further research, it would be interesting to see the effect of the length of time a property was held by a previous owner on the assessment value. As the number of years increases since the last sale of the property the assessed value may lag farther and farther behind market value. The new sale price could be different from the assessment determined when the previous owner lived in the property because there is lag in the reassessment based on sale price rather than the assessor calculations. The number of years since a property was last on the market could be a new independent variable included to this study

From this study there are also some policy implications that arise. Recently companies have started turning to automated valuation models (AVM) instead of using assessors to value property. These AVMs are more efficient in their valuation because it arrives at an assessment through a series of inputs that include the house characteristics instead of individual inspection. There is a certain formula that it follows and the AVM eliminates human error.

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