Neighborhood Foreclosures and Property Tax Burden: An Examination of Change in Valuation Standard and Assessment Equity

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Abstract:

The quality of property tax assessment practices impacts the stability of local government revenue and the equity of property tax burden. This study examines the potential shift in property tax burden associated with concentrations of foreclosures while taking into account a procedural transition from a lagged market versus a current market valuation standard. The findings suggest that property tax administration matters, especially with a growing number of foreclosures. In the case studied, current market value assessments partially mitigate equity consequences of nearby foreclosure sales. It is concluded that foreclosures have a relatively small, but significant negative effect on the change in assessed values of nearby properties. That shift mitigates the over-assessment associated with foreclosures under a lagged assessment standard. However, the analysis illuminates the continued complexity of achieving horizontal equity in the property tax base within or near higher concentrations of foreclosures after the transition to current market value assessment.

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Introduction

Nearly twenty years of empirical evidence suggests that foreclosures sell at a discount (Forgey, Rutherford, & VanBuskirk, 1994; Crawford & Rosenblatt 1995; Hardin & Wolverton, 1996; Pennington-Cross, 2006). That is, foreclosures are a negative neighborhood externality. The escalation of foreclosures in many urban areas during the past 10 years has increased scholarly attention on, and empirical evidence regarding, the negative external effect of nearby foreclosures on single family-residential property values (Immergluck &Smith, 2006; Shuetz, Been, & Ellen, 2008; Harding, Rosenblatt, & Yao, 2009; Lin, Ronsenblatt, & Yao, 2009; Leonard & Murdoch, 2009). Those findings suggest that local government revenue, which still is largely dependent upon property taxes in most states, may be expected to decline and/or shift tax burdens as market values (i.e., the base of the property tax) decline within neighborhoods of highly concentrated foreclosures. At a macro level, public finance scholars find that property tax revenue is the most stable broad-based tax revenue source for local governments, even during the most recent economic downturn(Mikesell & Mullins, 2008; Alm, Buschman, & Sjoquist, 2011; Carroll & Goodman, 2011). Empirical evidence suggests the stability of the tax base (i.e., aggregate assessed values), not increases in tax rates, is a key reason for property tax revenue stability (Lutz, 2008; Lutz, Molloy, & Shan, 2011; Alm et. al., 2011).

How do property tax revenues and rates remain stable when the increased frequency of neighborhood foreclosures is expected to negatively affect market values (i.e., the base of the property tax)? Speculation for why property tax revenue stability exists in an environment of increasing foreclosures may partially result from the property tax valuation standards implemented and/or the inability of assessing professionals to accurately and equitably assess properties in distressed neighborhoods. A distinction between the property tax and other broad-based taxes is the calculation of its base. The property tax base is derived from value estimates (i.e., assessed values) rather than transactions because relatively few properties sell in a given year. The standards for estimating the value of properties for property tax purposes varies by state (Chicoine & Giertz, 1988). Current market value assessment is the prescribed valuation standard for fairly and equitably distributing property tax burden among property owners (IAAO, 1999; Mikesell, 2004; Bowman & Mikesell, 1980). Beyond the valuation standard, scholars have found and practitioners have acknowledged that the ability to accurately and uniformly assess properties can vary by property and location characteristics (Thrall, 1979; Berry & Bednarz, 1975; Haurin, 1988; Goolsby, 1997; Allen & Dare, 2002; Payton, 2006; McMillen & Weber, 2008; Simpson, 2008; Wojcik, 2008; Payton, 2012).

For the past decade, foreclosure sales have represented a growing portion of single-family residential real estate activity in many urban communities (Immergluck, 2011). If assessed values are adequately tied to changing market values, then neighboring foreclosure sales may be expected to negatively affect the stability of assessed values within jurisdictions. That is, the impact of foreclosures on property tax assessment stability is likely a function of whether or not the valuation standard is current and adequately tied to market values. Furthermore, even under a current market valuation standard, higher concentrations of single-family residential foreclosure sales may create complexities that affect the ability of assessors to adequately estimate property values, which directly jeopardizes property tax equity.

The impact of property tax assessment standards and concentrated foreclosures on residential assessment equity of single-family residential properties is examined in this study. This study takes advantage of an urban community's transition from a lagged assessment standard (i.e., where assessed values essentially remained the same for multiple years) to a current market value standard (i.e., where assessors attempted to adjust assessed values to reflect market trends). Specifically, the extent to which assessed values diverge from market values as a result of nearby foreclosures is examined while taking into account the effect of current versus lagged assessments. The study period selected for this analysis directly allows for the examination of differences in valuation standards during a time of increasing foreclosures.

The findings suggest that foreclosures, at least in the urban area studied, are significantly related to a reduction in single-family residential assessed values as a result of transitioning to a current assessed value standard. The magnitude of that decrease is relatively small and may lead to an interpretation that recent foreclosures sales, even at higher concentrations, have a significant but minimal effect on assessment instability as current, more accurate, assessments are sought. While single-family residential assessed values generally match the drop in the level of market values (sale price as a proxy) in areas of higher foreclosure sales, the lack of assessment uniformity as the number of foreclosures sales increases is substantively the same. That is, the adverse equity consequences of foreclosures is only partially, but not fully, mitigated by a valuation standard implemented for the purpose of providing greater equity. In a valuation system that seeks full market value, that finding suggests that disproportionate growth in foreclosures across neighborhoods may lead to disproportionate and inequitable property tax burdens within an urban area. This study indicates that inequities related to a valuation standard that neglects the most current market value criterion is more vulnerable to market forces, such as foreclosures.

The next section provides a brief background on assessment standards, assessment equity, and neighborhood impacts of foreclosures. Then, the empirical framework, data, and results are examined. Finally, the article concludes with a summary and discussion of the findings.

Background

Assessment Standards

The property tax remains the most important own-source revenue for local governments in the United States. Seventy-two percent of local own-source tax revenue came from property taxes in 2007.[1] Public finance scholars tend to view the property tax more favorably than the general public (Mikesell, 2004). In principle, scholars recognize that the property tax is easy to collect; relatively stable and transparent; and local service quality and property wealth are related (Bowman and Mikesell, 1980; Yinger, Bloom, Boersch-Supan, & Ladd, 1988; Fisher, 1996; Mikesell, 2010). However, it is generally agreed that those elements that make the property tax a "good tax" in principle are reliant upon its administration.

The legal definition of "value" for property tax base purposes varies from state to state. Bowman and Mikesell (1980) explain that the word "value" in statutory property tax assessment requirements does not necessarily indicate that a valuation standard is based on actual current market values or that the "current market value" standard is the same from one state to the next. For instance, current-market-value-in-use is one form of assessment under the umbrella of the market value standard. That standard, as its name suggests, is based on the value of the property in its current use instead of the value of its highest and best use.[2] Statutory fractional assessments, whereby the assessed value is estimated as a fraction of total value, and acquisition value assessments, whereby the assessed value is based on historic purchase price of each property, are two other examples of divergence from the full current market value assessment. Both fractional assessment and acquisition value assessment standards have been found to negatively affect jurisdictional assessment equity (Shannon, 1969; O'Sullivan, Sexton, & Sheffrin, 1994, 1999; Sjoquist & Pandey, 2001).

The cycle for assessing properties may also result in a divergence from actual *current* market value assessments and may have direct ramifications on assessment stability and equity, especially under fluctuating market conditions. There are three general types of cycles: mass assessment cycles, segmental assessment cycles, and annual assessment. Within a mass assessment cycle standard, existing properties are assessed on a specified date and assessed values do not change until the next mass assessment unless the use of the parcel is changed, demolished, or improvements are added. The time lag between assessment cycles typically ranges from two to ten years (Mikesell, 2010, p. 499). Segmental assessments are similar to mass assessment, except geographic segments of the jurisdiction are assessed on a cyclical basis.[3] Changes in market values over longer periods between mass and segmental assessments may significantly affect the relationship between assessed values and actual current market values due to market changes between assessment periods. Ideally, a current market value property tax assessment system results in a tax base that accurately and transparently reflects, or equals, the market values of properties as those values change over time. Annual assessments, or adjustments, are one way to potentially achieve near-current assessed values.

A more current market valuation standard versus extended lags in assessments has important implications for the stability and equity of property tax burden. Under a lagged valuation system, the assessed value of existing properties remains constant over the lag period. The assessed values of properties remain stable at least for the years between assessments while market values may change. Owners of properties for which the market value has increased during that period pay less than their fair share of property taxes at the expense of owners whose property values declined. In short, while lagged assessed values of properties remain stable during that period, equity in property tax burden is threatened.

Assessment Equity and Systematic Bias

The valuation standard and the condition of properties and neighborhoods within a jurisdiction may separately or together affect stability and equity of property tax burden within and among local governmental units. Assessment equity is reliant upon both the valuation standard and the application of that standard by assessors. A true ad valorem tax, whereby the tax is levied proportionally on the base value, requires that homes with similar market values be taxed at the same rate (i.e., proportionally). Uniformity of taxation between comparable properties is known as horizontal equity. Empirical analyses have shown that state laws and assessment standards directly affect assessment equity. Specifically, empirical findings suggest that property tax assessment equity may be affected by the valuation standard, level of government primarily responsible for assessment, whether or not the assessor is elected or appointed, and the time lag between assessments (Geraci, 1977; Bowman & Mikesell, 1978; Bowman & Mikesell, 1990; O'Sullivan et al., 1994; Giertz & Mehta, 1996; Strauss & Sullivan, 1998). Similarly, property and neighborhood characteristics such as size of house, age of house, neighborhood racial and household income composition, and frequency of sales in the surrounding neighborhood may lead to diverging tax burdens between two properties with similar market values (Black, 1972; Berry & Bednarz, 1975; Schroeder & Sjoquist, 1976; Almy, 1977; Ihlandfeldt & Jackson, 1982; Haurin, 1988; Goolsby, 1997; Allen & Dare, 2002; Strauss & Strauss, 2004; McMillen & Weber, 2008, Payton, 2012).

Assessment standards and/or practices may lead to lack of uniformity in a systematic or nonsystematic way. Systematic bias may be associated with assessor tendencies to, or standards that, purposefully or unintentionally lead to under- or over-assessment of properties with differing attributes. If certain property and neighborhood characteristics lead to greater systematic assessment bias, then owners of properties that differ only by a particular property or neighborhood attribute will systematically pay higher (lower) effective tax rates for the same local government services.

Property Values and Frequency of Non-foreclosure and Foreclosure Sales

Scholars not only have examined the discount price of foreclosed home sales, but also the external costs and societal impacts of concentrated home foreclosures on communities. Foreclosures have been found to have a negative effect on the value of surrounding properties and increase costs for local governments (Forgey et al., 1994; Crawford & Rosenblatt, 1995; Moreno, 1995; Hardin & Wolverton, 1996; Apgar & Duda, 2005; Carroll, Clairetie, & Neill, 1997; Immergluck & Smith, 2006; Pennington-Cross, 2006). Based on those findings, it is reasonable to assume that high concentrations of foreclosures may, or should, negatively affect assessed values.

The introduction of market complexity that results from foreclosure sales also may have ramifications on assessors' ability to equitably value properties. Particularly relevant to examining the effect of foreclosures sales on assessment equity, Allen and Dare (2002) and McMillen and Weber (2008) show that more arms-length sales in a neighborhood prior to reassessment lead to more uniform and less biased assessed values. McMillen and Weber (2008) reason that thicker markets (i.e., more sales) provide more information relevant to the market price of a property than thinner markets (i.e. fewer sales), presumably making it easier for assessors to accurately and uniformly estimate market values. However, growing concentrations of foreclosure sales, competing with non-foreclosure sales, within some of those markets may cause greater complexity in the assessment process (Lifflander 2008; Simpson 2008).

Empirical Framework

As Berry and Bednarz (1975) explain, there are at least three features that affect property tax assessment equity. First, there are factors that influence assessor judgment that are not related to market value determination. For instance, the valuation standard under which the assessor operates may affect assessment equity (e.g., lagged assessments, non-market value assessments, or acquisition value assessments). In that case, the standard may be primarily responsible for variation in assessment equity. Second, there may be factors that affect market values that are not adequately considered by assessors (e.g., neighborhood distress associated with a concentration of foreclosures). Finally, there are property attributes that assessors simply value differently than the market (e.g., land value).

In this study, the primary focus is on the extent to which the external effect of foreclosures is equally reflected in assessed values and market values under two valuation standards, holding all other determinants constant. For the purposes of this analysis, a series of ordinary least squares (OLS) models are used to isolate the relationship between foreclosure sales and the assessment base (a form of stability), systematic bias (equity measure), and dispersion (equity measure). Table 1 illustrates how each of those measures is defined.[4]

Two dependent variables measure the effect of foreclosures on assessed value stability as a result of current assessment adjustment. Two additional dependent variables measure the equity implications associated with foreclosures in terms of systematic bias and relative (i.e., horizontal) equity at the parcel level. To provide a baseline, the relationship between property attributes and current assessed values (AV_i) is examined. A ratio, $CurrentAV_i/LaggedAV_i$, is used as a dependent variable to evaluate the differences in attribute effects on stability that is associated with adjusting lagged assessed values to current assessed values. The same sample of properties, varying only in assessed values, must be examined to account for that difference. "Lagged assessed values" reflect the assessed values of properties that would have been retained had the current assessment adjustment not been implemented.

Therefore, this analysis addresses the difference between a previous assessment that is associated with a lagged cycle and that which is associated with changing assessed values.

Two models are used to examine the impact of transitioning to current market value assessments on potential systematic bias. One model is the assessment-sales ratio ($Current\ AV_i/MV_i$) based on current assessed values and the other is based on lagged ($Lagged\ AV_i/MV_i$) assessments (i.e., assessed values that would have been in place had the current assessed value adjustment not occurred). Those measures (AV_i/MV_i) are similar to measures of systematic bias used by Berry and Bednarz (1975) and Goolsby (1997). Specifically, that measure examines the extent to which properties are generally over- or under-assessed relative to market value.

Similar to Allen and Dare (2002), dispersion (uniformity) in assessments is measured by the absolute value of the difference between the assessment-sales ratio of each observation and the sample mean assessment-sales ratio for both current ($|Current\ AS_i - Current\ AS_{mean}|$)and lagged assessed values ($|Lagged\ AS_i - Lagged\ AS_{mean}|$).Those models examine horizontal equity. For instance, if a given determinant has a significant and positive relationship with ($|Current\ AS_i - Current\ AS_{mean}|$, then that determinant is associated with greater horizontal inequity (i.e., similar properties would be expected to be taxed at different effective rates).

The variation in all dependent variables is examined as functions of property, neighborhood, and jurisdictional characteristics (see Equation 1). All model specifications are semi-log. The semi-log transformation is justified to reduce heteroskedasticity that is associated with highly skewed variables. The log transformation of the dependent variable also is theoretically appropriate given that the marginal effects of the independent variables are likely proportional to the observed levels of the dependent variables. All independent variables are the same across models. That is, the dependent variable is the only variable to change among the models.

$$lnY_i = \beta_0 + \beta_k S_k + \beta_l L_l + \beta_h R_h + e \qquad (1)$$

Where:

Y = a vector of dependent values

S_k = vector of property characteristics
L_l = vector of location characteristics
R_h= vector of jurisdiction variables
β_0, β_k, β_l, and β_h= corresponding parameters
e = vector of errors

The focus of this paper is on the effect of foreclosure concentrations on property tax burden as assessors implement a current market value standard. The effect of foreclosure sales on property tax assessment stability, systematic bias, and dispersion (uniformity) is operationalized by adding to the models the frequency of foreclosed and non-foreclosed properties within multiple radii. For brevity, *X* is shorthand for all other characteristics used in the previously explained base model.

(2)

$$lnY = \beta_0 + \beta_{fj}(\text{foreclosures})_{fj} + \beta_{nj}(\text{non-foreclosures})_{nj} + \beta(\mathbf{X}) + e$$

Where:
(foreclosures) = a vector of the number of foreclosures within radii *j*
(non-foreclosures) = a vector of the number of non-foreclosures within radii *j*
B_o, β_{fj}, and β_{nj}= corresponding parameters
e = vector of errors

Including non-foreclosure sales in each of the specifications is important for at least two reasons. First, other scholars have found that non-foreclosure sales (e.g., arm-length transactions) are significantly related to assessment performance (Allen & Dare, 2002; McMillen & Weber, 2008). Secondly, including both foreclosures and non-foreclosures in adapted versions of the models allows for an additional hypothesis to be tested—that is, the differential effect of foreclosures and non-foreclosures on each of the dependent variables can be tested.[5]

Marion County as a Case Study

Marion County (primarily Indianapolis), Indiana, is properly suited for this analysis. Marion County is an urban area of a state that mandated a property tax assessment standard to current market value assessment and experienced relatively high levels and concentrations of single-family residential foreclosures during the period studied. It contains an adequate amount of social and housing stock diversity. Marion County is the core county of the Indianapolis Metropolitan Statistical Area (MSA). In his national study of foreclosure rates in the 75 largest MSAs, Immergluck (2011) found the Indianapolis MSA to be a traditional weak-to stable-market metropolitan area with an accumulation and concentrations of neighborhood foreclosures consistent with Minneapolis, Atlanta, Detroit, Memphis, Cleveland, and Denver (2011, p. 138). These MSAs have experienced a disproportionate share of high foreclosure concentrations in the core city.

Figure 1 shows the percentage of sales that were foreclosed in Marion County for a four-year period beginning in 2003. From 2003 through 2006, the proportion of sold properties that were real estate owned (REO) – synonymous with foreclosures for purposes of this study – increased from 11 percent to 26 percent of all properties sold in 2006. REO properties represent properties that are retained by lending institutions after not selling at foreclosure auctions. Indiana is a "judicial foreclosure" state. Therefore, the time period in which it takes a foreclosed property to sell may be extended relative to a "non-judicial" state. Figure2 illustrates the spatial concentration of foreclosures in 2004 and 2005.

Marion County also was part of a 2002 statewide reform to meet prescribed current market value assessment of properties. The 2002 reform was the result of a 1998 Indiana Supreme Court ruling that found Indiana's property tax assessment system unconstitutional (S*tate Board of Tax Commissioners v Town of St. John*,1998). Prior to 2002, the Indiana property tax assessment standard was not based on market values. Assessed values (known in Indiana as true tax values) were based on reproduction costs and were adjusted by a formula that was controlled by a state regulatory commission. The Indiana Supreme Court found that Indiana's pre-2002 non-market based administrative formula assessment standard violated the state constitution. Essentially, the Court's 1998 and subsequent rulings required the state to change its property tax system to a market value standard. Technically, the new standard is current-market-value-in-use.

An assessment trending process was established as a part of the 2002 reform. The initial 2002 market value assessments were based on 1999 cost tables and held constant through 2005. Starting in 2006, the assessments are trended each year between mass appraisal cycles.[6] The Indiana Department of

Local Government Finance (DLGF) develops the rules for annually adjusting assessed values. Based on DLGF rules, local assessors are responsible for determining the market value of single-family residential properties by comparing local sales that have occurred during the previous two years. For instance, the Marion County assessors primarily used arms-length sales that occurred during 2004 and 2005 to estimate assessed values in 2006.[7] The intent of trending is increased accuracy and uniformity of assessments.

Admittedly, analysis of a single county jeopardizes some aspects of generalizability. However, such a focus provides a unique opportunity to directly analyze the relationship between the external effect of foreclosures and the property tax base in an urban environment where foreclosure sales have tended to accumulate and concentrate. Like similar studies analyzing property tax assessment performance in a single urban county (Berry & Bednarz, 1975; Ihlandfeldt & Jackson, 1982; Sjoquist & Pandy, 2001; Allen & Dare, 2002), this case study allows for a narrower focus on property and neighborhood attribute effects between a lagged assessment and current assessment without the complexity of other intervening factors, such as differing administrative structures and resource availability. Additionally, assessed valuation for property tax purposes was completed by multiple assessors at the township level. Therefore, consistent with many urban areas, this analysis accounts for multiple assessors valuing properties within urban and suburban contexts.

Data

The independent variables are the same across all of the previously explained models. The dependent variables for each of the models are developed for the purpose of comparing stability and equity between a current assessment and a lagged assessment (i.e., as if assessed values remained unchanged). Specifically, 2006 assessed values of single-family residential properties are used to reflect current market value assessments. Importantly, that was the first year Indiana established and Marion County implemented an annual assessment adjustment. The 2005 assessed values for the same properties are used to compare the relationship of the independent variables on assessment stability and equity between current and lagged assessments. The 2005 assessed values were based on 2002 mass appraisals, which were primarily derived from 1999 cost replacement tables. The 2005 transition marks an important transition in the valuation process. For that reason, the transition to the 2005 assessments is an important factor for examining a changing assessment process.

Table 2 provides the definitions and descriptive statistics of the variables used in the models. The primary data sources for this analysis are the Marion County (Indiana) Assessor's Office, Indiana Department of Local Government Finance (DLGF), and Metropolitan Indianapolis Board of Realtors (MIBOR). Those data are at the parcel level. Assessment-sales ratios are calculated for single-family residential properties by dividing the 2005 (lagged assessments) and 2006 (current assessments) gross assessed values by the sale price of properties that were sold between April 1, 2006 and March 31, 2007.[8] The post-assessment sales data were utilized to avoid issues related to sales chasing. All unit sale prices in the study are necessarily independent of the sale prices utilized to determine assessed values.

The number of foreclosure and non-foreclosure sales that occurred in 2004 and 2005 are the focus of the analysis.[9] The number of foreclosure and non-foreclosure sales within the 2004 and 2005 timeframe is chosen because that is the period within which the Marion County Assessor's Office used comparable sales for trending assessments in 2006. Those data were collected from the MIBOR multiple listing service database. The model specifications include four variables of primary interest: number of foreclosed properties sold within 1/8 mile, number of foreclosed properties sold within 1/8 and ½ mile, number of non-foreclosed properties sold within 1/8 mile, and number of non-foreclosed properties sold within 1/8 and ½ mile.[10] Various radii were chosen to capture the potential non-linear effect of sales under the presumption of Tobler's first law of geography, "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970, p. 236). That is, the influence of each sale is expected to decrease the farther it occurs from a given property. Including the number of non-foreclosures sales controls for the differential relationship between those sales and foreclosure sales. The inclusion of the remaining determinants is guided by the literature.

Two neighborhood determinants in the model are at the block group level and were collected from the 2000 Decennial Census. Those variables include median household income and proportion non-white population. Several studies have tested the effect of income and non-white population on market values, systematic assessment bias, and assessment uniformity (Black, 1972; Berry & Bednarz, 1975; Schroeder & Sjoquist, 1976; Almy, 1977; Ihlandfeldt & Jackson, 1982; Haurin, 1988; Goolsby, 1997; Strauss & Strauss, 2004). Generally, previous findings suggest that market values increase and assessments are more uniform in higher income areas and in areas with lower proportions of non-white populations. A presented justification for those effects is that lower-income residents and minority residents are likely to have less political clout, thus, assessors are more likely to provide less attention in those areas (Bowman & Mikesell, 1978; Bowman & Mikesell, 1990). Gilderbloom, Hanka, and Ambrosius (2012) find no significant relationship between assessment equity and variables measuring class and race at the Census tract level. In the case of the assessed values presented in this analysis, the direction of those neighborhood attributes on systematic bias and uniformity are difficult to know *a priori*. Previous studies have focused on mass appraisals whereby assessors may have more latitude in the characterization of a subject property. The 2005 assessed values are based on lagged assessments with unchanging assessed values since 2002 and are compared to the price of sales that occurred much later. The 2006 assessed values are based on a "mechanical" trending process whereby assessed values are adjusted by sales comparisons. The purpose of those variables is to control for other neighborhood effects besides foreclosures.

Property, or market, heterogeneity also is typically included as a variable that affects assessed values, equity, and systematic assessment bias (Schroeder & Sjoquist, 1976; Bowman and Butcher, 1986; Chicoine & Giertz, 1988). Generally, it is expected that the market values of properties in more heterogeneous neighborhoods are more difficult to estimate and may lead to greater divergence in assessment equity. The measure of property heterogeneity is somewhat inconsistent across studies. Typically, it is defined through measures of sales price or age heterogeneity. Property heterogeneity is tested in this study by categorizing various properties into age cohorts: 1940; 1940 to 1969; 1970 to 1990, 1990 to 1999, 2000 to 2006. The data for developing the cohorts come from the assessment records of residential properties. All single-family parcels are assigned to one of the five cohorts. Then, the proportion of structures in each census block group is calculated for each age cohort. Finally, the sample observations are assigned to their age cohort and the proportion of properties built outside that cohort is calculated.

Market heterogeneity is measured by two variables, proportion of units built before and proportion built after. Lower proportions of properties built in cohorts before and after indicate that a property is located in a more homogeneous neighborhood. Higher proportions of newer and older properties indicate that the neighborhood is more heterogeneous. More heterogeneous neighborhoods are known for being difficult to obtain accurate assessed values and result in less uniform assessments (IAAO, 1999)

Property variables in the models include square feet open land[11]on property, proportion of open land on property, square feet living area, and the age of the structure. There is a natural potential for the size of the parcel or size of the parcel relative to the structure footprint to lead to assessment error when land and improvements (i.e., structures) are initially assessed separately – as is the case for the 2005 assessed values of observations in this study. That is, more land may be more likely to lead to assessment error. *Square Feet Open Land* addresses the effect of the absolute size of the parcel. *Proportion of Parcel Open Land* addresses the amount of land relative to the footprint of the house.

Total square feet of a residential house also is included in the model. Berry and Bednarz (1975) and Goolsby (1997) find that larger houses are over-assessed in their samples of systematic bias. Accordingly, Allen and Dare (2002) find that the assessment-sales ratios are less uniform for larger houses than for smaller houses.

Age of structure also is commonly included in studies that examine property assessment error. A typical finding is that uniformity and systematic bias are inversely related to age. That is, older properties are harder to accurately assess and generally are under-assessed relative to newer properties (Berry & Bednarz, 1975). Valuation systems tend to lead to over-depreciation of properties.

Finally, jurisdictional variables are included in the model. Township binary variables are included to measure unobservable effects as a result of multiple township assessors being primarily responsible for the assessment process and general differences in housing stock. There are nine townships in Marion County. Center Township, the most central portion of the county (i.e., central city), is omitted from the models. Therefore, all township effects are relative to the most central township in the county.

Results

Table 3 shows the OLS results for the relationship between each of the variables and the 2006 assessed values. It also shows the changes in relationships from the lagged assessment (2005) and the current assessment (2006). Approximately 81 percent of the variation in 2006 assessed values is explained by the independent variables in the model. Effectively, that model shows the effect property and neighborhood characteristics on property values as defined by the assessors. The sign of each characteristic is consistent with expectations. The proportion of properties in the neighborhood built in newer cohorts is the only variable that is not at least significant at $p<0.05$. As may be expected, neighborhood income, proportion of neighborhood units built before, square feet living area, proportion of parcel open land, and square footage of parcel open land are all positively related to current assessed values. Proportion non-white and age of the structure are negatively related to assessed values. Each additional surrounding foreclosure sale has a negative effect and non-foreclosure sales have a positive effect on assessed values at $p<0.01$.

The cross-sectional model examining the relationship between each characteristic and current assessed value provides an indication of the implicit assessed value for each characteristic. However, the difference in the effect of each characteristic on lagged and current assessed values is examined by the ratio of assessed value in 2006 (current) and 2005 (lagged), or $Current\ AV_i./Lagged\ AV_i$. The assessed value ratio model provides a better indication of difference in the relationship between each independent variable and current and lagged assessed values. The results indicate that foreclosure sales that occurred during the two years prior to the assessment adjustment lead to a decrease in assessed values. That is, properties located among more foreclosure sales have significantly lower assessed values after the current assessed value adjustment. That effect is significantly different than the positive relationship associated with more non-foreclosures on the change in assessed values.

Since the model is log-level, coefficients may be multiplied by 100 and interpreted as percentage change in the dependent variable for each one unit change in the independent variables. For instance, the relationship between an additional foreclosure sale within 1/8 mile and the *Current AV/Lagged AV* is negative 0.50 percent after the assessment adjustment. An additional foreclosure after trending in this case results in an approximate $855 reduction in assessed value. Increasing the number of foreclosures within 1/8 mile by one standard deviation above the mean number foreclosures sales yields an estimated 1.5 percent, or an approximate $2,165 lower assessed value as a result of the current market value assessment adjustment. Each additional foreclosure previously sold between 1/8 and ½mile represents a 0.314 percent reduction in *Current AV/Lagged AV*. A one standard deviation increase in the number of foreclosed residential property yields an estimated 6.1 percent, or an approximate $7,873 reduction in assessed value change. These findings still are consistent with Tobler's First Law of Geography. The effect of one additional foreclosure on assessed value is smaller as distance from a given property increases. The relatively larger reduction at one standard deviation is the result of greater variation in the number of foreclosures between 1/8 and ½ mile.

Table 4 shows the relationship between each of the determinants and the two equity measures. First, the results of systematic bias are shown for lagged and current assessed values (i.e., $Lagged\ AV_i/SP_i$ and $Current\ AV_i/SP_i$).Those models show the extent to which foreclosures lead to under- or over-assessment. The relationship between each determinant on the dispersion from the county mean for lagged and current assessments (i.e., $|Lagged\ AS_i – Lagged\ AS_{mean}|$ and $|Current\ AS_i – Current\ AS_{mean}|$) also is shown. A positive coefficient in the dispersion models represents increased assessment error (i.e., greater horizontal inequity).

Generally, the results indicate that systematic bias associated with the base neighborhood and property determinants was reduced (with the exception of a few variables) after the annual adjustment. The amount of variation explained in the models of systematic bias (A/S) is smaller after the assessment adjustment. Significant dispersion reduction was not as wide spread after the annual adjustment for those determinants that were positively related to the dispersion measure under the lagged assessment.

Foreclosures have a significant, positive effect on systematic bias under lagged assessments. Similar to most of the other determinants, the systematic bias associated with foreclosures was significantly reduced through current assessments. Each additional foreclosure within 1/8 mile is associated with a 0.5 percent increase before and not significantly different from zero after the current assessment adjustment. Properties are over-assessed by 0.3 percent for each additional foreclosure sale between 1/8 and ½ mile under the lagged assessment and do not have a significant systematic relationship after the current assessment adjustment.

Increasing the number of foreclosures by one standard deviation shows the relative effect of larger concentrations of foreclosures holding everything else constant. One standard deviation increase in foreclosure sales within 1/8 mile under the lagged assessment would have resulted in a 1.50 percent increase in the assessment-sales ratio. A one standard deviation increase in foreclosure sales between 1/8 and ½ mile resulted in a 6.2 percent increase under the lagged assessment-sales ratio. As one would expect, the lagged, non-adjusted assessed values cannot account for the discount effect on property values associated with recent foreclosures sales. The ramifications can be fairly substantial for some properties if that relationship holds fairly consistently as concentration levels of foreclosure sales increases.

The number of foreclosures sold during the past two years is generally related to less uniformity (i.e., positive dispersion).The effect of non-foreclosures sold on the dispersion measure under lagged and current assessed values is consistent with the notion that recent, nearby arms-length, non-foreclosure property transactions provide more information to the assessor (McMillen and Weber, 2008). Equity dispersion after the current assessment adjustment, however, decreases marginally as the number of non-foreclosure sales increases.

The effect of each additional property sold on dispersion depends on whether or not the neighboring sale is a foreclosure and whether or not the assessment has been adjusted to current market value. Each additional foreclosure within 1/8 mile is associated with a 1.76 percent increase in dispersion (less uniform) under the lagged assessment and increases by 1.33 percent after the current market value adjustment.[12] If the additional sale was a non-foreclosure, dispersion is reduced by nearly two percentage point after the current market value assessment adjustment. The dispersion of the assessment-sales ratios from the county mean assessment-sales ratio is 0.23 percent for each additional foreclosure sale between ½ and 1/8 mile under the lagged assessment and is nearly the same (0.26 percent) under current market value assessment. If the additional sale had been a non-foreclosures sale instead of a foreclosure sale, dispersion from the county mean A/S would have been expected to drop by 0.33 percentage points in 2006.

The magnitude of the association between recent foreclosure sales and dispersion is amplified by examining the coefficients at relatively higher levels of concentration and assuming the relationship holds across the distribution. A one standard deviation in foreclosures is associated with an eight percent increase in the absolute deviation of the assessment-sales ratio from the county mean ratio after the adjustment. The dispersion associated with increased surrounding foreclosures sale is substantively equal to the estimated 9.5 percent increase within the same radii and at the same concentration level (i.e., one standard deviation) if the current market value adjustment had not occurred.

Summary and Discussion

The empirical analyses show that higher concentrations of recent foreclosures sales may significantly affect the stability and equity of the property tax base within residential class properties in urban areas. The substantive relationship between foreclosure sales and assessment stability (i.e., examination of the difference in the effect between foreclosure sales under lagged and current assessed values) is relatively small. However, through the examination of parcel level data, this study finds that a portion of that small effect may be attributed to the lack of uniformity in assessed values as the concentration of foreclosure sales increases and concentration of non-foreclosures decreases around subject properties.

As expected, the attempt to adjust assessments to current values reduced some harmful equity implications of foreclosures. However, even under the more current assessed values, the magnitude of those harmful effects on assessment uniformity (measured by A/S dispersion from the county mean) is fairly substantial as concentrations reach at least one standard deviation from the mean. Generally, the adjusted assessed values mitigated the systematic over-assessment of properties within higher concentrations of foreclosures. That is, foreclosures generally affect future sale prices and assessed values in similar ways. However, the dispersion models indicate that similar properties may be assessed quite differently as the number of foreclosures increases. That is, overall systematic bias toward over-assessment may be mitigated with current assessments, but the variation among similar properties in highly concentrated areas is more difficult to address.

The implications of these findings are important for understanding the impacts of neighborhood externalities, like foreclosures, on property tax administration. Generally, the effects of foreclosures on housing prices are well documented. Most studies find that higher foreclosure concentrations serve as negative externalities, as higher concentrations of foreclosures reduce the price of nearby properties. However, local governments generally do not experience immediate revenue shortfalls that are expected as a result neighborhood decline, in this case with a growing concentration of foreclosures. The fairness in tax burden in urban areas, on a neighborhood-by-neighborhood basis, may be affected substantially as a result of higher concentrations of foreclosures (Immergluck, 2011). This paper shows that the effect on tax burden may be mitigated by adjusting assessments on a more rapid cycle (i.e., not allowing long lags between cycles where assessed values remain constant over an extended period of time). As the clustering of foreclosures may occur over different periods of time and varies by neighborhood, so to should assessments to protect property owners from inequitable tax burden. While assessors should not be expected to perfectly predict future assessed values, a more current system may mitigate extreme circumstances of property tax inequity.

It should not be inferred that such concentrations of foreclosures deem the property tax unworthy as a local government revenue sources. Instead, the findings point toward policies and standards that maintain a current and fair property tax burden among taxpayers. Lagged assessments, especially in areas that experience high concentrations of distress, may lead to inequitable tax burden shifts – some of which may be mitigated by current market value adjustments. Also, higher concentrations of foreclosures that caused complexities in the market were not developed by assessors. The fact that assessors are unable to accurately assess properties as the number of foreclosures increases is apparent through the findings comparing the relationship between assessment adjustments and dispersion. In this case, the over-assessment associated with higher concentrations of previous foreclosures sales was mitigated after the current market adjustment; the findings indicate that lack of uniformity (i.e., dispersion)may be the bigger issue. While the shift in the point estimate for over-assessment after current assessed value adjustment should not be ignored, the effect of recent foreclosures on property tax equity indicates that the complexities in assessment are encountered as a result of increasingly distressed areas.

Understanding the impacts foreclosures have on market values and the implementation of a valuation process that accurately represents market conditions, especially during time of high foreclosures, may be a challenge for local assessors. It is an important challenge that requires instilling taxpayer confidence in historically one of the least appreciated taxes. State policies that maintain transparent, current valuation systems may assist assessors with meeting that challenge.

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Tables

Table 1: Measures Used as Dependent Variables

Stability Measures		
	Current AV_i	Where: AV_i = Assessed value of each observation
	Current AV_i/*Lagged* AV_i	
Equity Measures		
	Systematic Bias	
	Current AV_i/MV_i	Where: AV_i = Assessed value of each observation MV_i= Market value of each observation
	Lagged AV_i/MV_i	
	Dispersion (Uniformity)	
	$\lvert$*Current* AS_i - *Current* $AS_{mean}\rvert$	Where: $AS_i = AV_i/MV_i$ $AS_{mean}= \Sigma AS_i/n$
	$\lvert$*Lagged* AS_i - *Lagged* $AS_{mean}\rvert$	

Table 2: Variables and Descriptions, Marion County, Indiana (n=9,435)

Variable	Description	Mean	St. Dev
Dependent Variables: Stability			
Lagged AV	Gross Assessed Value 2005	110,089.10	72,671.05
Current AV	Gross Assessed Value 2006	130,107.8	95,922.11
Current AV/Lagged AV (x100)	2006 Gross Assessed Value/2005 Gross Assessed Value	118.35	26.92
Dependent Variables: Systematic Bias			
Lagged AV/SP (x100)	2005 Gross Assessed Value/Sales Price [(April 1, 2006 through March 31, 2007)	86.65	24.57
Current AV/SP (x100)	2006 Gross Assessed Value/Sales Price (April 1, 2006 through March 31, 2007)	98.98	17.63
Dependent Variables: Dispersion			
$\lvert$Lagged AS_i – Lagged $AS_{mean}\rvert$ (x100)	Absolute Value of the Difference between A/S_i and County Mean A/S 2005	14.90	19.53
$\lvert$Current AS_i – Current $AS_{mean}\rvert$ (x100)	Absolute Value of the Difference between A/S_i and County Mean A/S 2006	11.79	13.11
Independent Variables			
Number of foreclosed units <1/8 mile	Frequency of foreclosed properties sold within 1/8 mile of property	2.07	2.73
Number of foreclosed units 1/8 to ½ mile	Frequency of foreclosures between 1/8 to ½ mile	19.28	20.49
Number of non-foreclosed units < 1/8 mile	Frequency of non-foreclosed properties within 1/8 mile of property	8.13	6.52
Number of non-foreclosed units 1/8 to ½ mile	Frequency of non-foreclosed properties between 1/8 mile of property	77.61	44.17
Median block group Income ($1,000)	Median income for the block group	51.23	20.03
Proportion non-white	Proportion of the population non-white	23.58	25.64
Proportion units in block group built before (cohort)	Proportion of properties built before the property	22.21	26.68
Proportion units in block group built after (cohort)	Proportion of properties built after property	19.99	24.39
Structure age	Age of structure	39.16	27.98
Square feet living area (100)	Square feet living area	15.80	6.52
Proportion of parcel unimproved land	Proportion of property unimproved land	86.40	7.50
Square feet of parcel unimproved land (10,000)	Square feet of parcel unimproved land	1.15	2.99
Center	Binary Variable; 1 if in Centerr Township, 0 else.	0.11	0.31
Decatur	Binary Variable; 1 if in Decatur Township, 0 else.	0.03	0.17
Franklin	Binary Variable; 1 if in Franklin Township, 0 else.	0.07	0.25
Lawrence	Binary Variable; 1 if in Lawrence Township, 0 else.	0.16	0.37
Perry	Binary Variable; 1 if in Perry Township, 0 else.	0.12	0.32
Pike	Binary Variable; 1 if in Pike Township, 0 else.	0.08	0.28
Warren	Binary Variable; 1 if in Warren Township, 0 else.	0.15	0.36
Washington	Binary Variable; 1 if in Washington Township, 0 else.	0.15	0.36
Wayne	Binary Variable; 1 if in Wayne Township, 0 else.	0.12	0.33

Table 3: OLS Results of Current Assessed Value and Difference from Lagged Assessed Value, Marion County, Indiana (n=9,435)

		ln (Current AV) Coeff. (St. Err)		*ln*(Current AV/Lagged AV) Coeff. (Std. Err.)	
Frequency of sales surrounding parcel 04-05	Foreclosed Units <1/8 mile	-0.01846 (0.00124)	**†	-0.00504 (0.00087)	**†
	Non-foreclosed units < 1/8 mile	0.00317 (0.00049)	**	0.00085 (0.00034)	*
	Foreclosed units 1/8 to ½ mile	-0.00632 (0.00020)	**†	-0.00314 (0.00014)	**†
	Non-foreclosed units 1/8 to ½ mile	0.00142 (0.00007)	**	0.00052 (0.00004)	**
Neighborhood Variables (Block Group)	Median Income ($1,000)	0.00413 (0.00018)	**	0.00003 (0.00013)	
	Proportion non-white	-0.00084 (0.00014)	**	0.00088 (0.00010)	**
	Proportion before (cohort)	0.00029 (0.00013)	*	-0.00023 (0.00009)	**
	Proportion after (cohort)	0.00002 (0.00012)		-0.00039 (0.00006)	**
Property Variables	Structure age	-0.00211 (0.00015)	**	0.00233 (0.00011)	**
	Square feet living area (100)	0.04360 (0.00047)	**	0.00110 (0.00033)	**
	Proportion parcel unimproved	0.00080 (0.00037)	*	-0.00046 (0.00026)	
	Sqft Unimproved Area (10,000)	0.00710 (0.00087)	**	0.00120 (0.00061)	*
Jurisdictional Variables	Decatur	0.03755 (0.01838)	*	-0.04779 (0.01284)	**
	Franklin	0.03623 (0.01501)	*	-0.05591 (0.01048)	**
	Lawrence	0.12852 (0.01265)	**	0.00302 (0.00884)	
	Perry	0.06262 (0.01276)	**	-0.07061 (0.008910)	**
	Pike	0.11267 (0.01440)	**	-0.04927 (0.01006)	**
	Warren	0.02992 (0.01140)	**	-0.07343 (0.00796)	**
	Washington	0.31770 (0.01206)	**	-0.00177 (0.00843)	
	Wayne	0.08079 (0.01141)	**	-0.05363 (0.00797)	**
	_cons	10.64761 (0.03693)	**	0.13195 (0.02580)	**
	R^2=	0.8133		0.2332	

***p<=0.01;*p<=0.05*

†Indicates that the difference in the coefficients for foreclosures and non-foreclosures is significant at p<0.05

Table 4: OLS Results of Equity - Systematic Bias and Dispersion, Marion County, Indiana (n=9,435)

		Systematic Bias		Dispersion	
		Lagged *ln*(AV/SP)	Current *ln*(AV/SP)	Lagged $\ln(\lvert AS_i - AS_{mean}\rvert)$	Current $ln(\lvert AS_i - AS_{mean}\rvert)$
		Coeff. (St.Err)	Coeff. (St.Err)	Coeff. (St.Err)	Coeff. (St.Err)
Frequency of sales surrounding parcel 04-05	Foreclosed Units <1/8 mile†	0.00490 **† (0.00114)	0.00014 (0.00087)	0.01764 **† (0.00590)	0.01333 **† (0.00603)
	Non-foreclosed units < 1/8 mile	-0.00050 (0.00045)	-0.00035 (0.00034)	-0.00268 (0.00231)	-0.00637 ** (0.00236)
	Foreclosed units 1/8 to ½ mile†	0.00299 **† (0.00018)	0.00015 (0.00014)	0.00231 *† (0.00096)	0.00256 **† (0.00095)
	Non-foreclosed units 1/8 to ½ mile	-0.00048 ** (0.00007)	-0.00004 (0.00005)	0.00020 (0.00035)	-0.00074 * (0.00035)
Neighborhood Variables (Block	Median Income ($1,000)	-0.00067 ** (0.00017)	-0.00070 ** (0.00013)	-0.00006 (0.00088)	-0.00181 * (0.00090)
	Proportion non-white	-0.00126 ** (0.00013)	-0.00037 ** (0.00010)	0.00488 ** (0.00065)	0.00173 ** (0.00067)
	Proportion before (cohort)	0.00025 * (0.00012)	0.00002 (0.00009)	0.00363 ** (0.00060)	0.00207 ** (0.00062)
	Proportion after (cohort)	0.00042 ** (0.00011)	0.00003 (0.00008)	-0.00015 (0.00056)	0.00077 (0.00057)
Property Variables	Structure age	-0.00297 ** (0.00014)	-0.00064 ** (0.00011)	0.00881 ** (0.00072)	0.00772 ** (0.00073)
	Square feet living area (100)	0.00142 ** (0.00043)	0.00251 ** (0.00033)	0.01055 ** (0.00222)	-0.00012 (0.00226)
	Proportion parcel unimproved	0.00109 ** (0.00034)	0.00063 * (0.00026)	0.00022 (0.00175)	-0.00056 (0.00179)
	Sqft Unimproved Area (10,000)	-0.00226 ** (0.00080)	-0.00106 (0.00061)	0.00240 (0.00413)	0.00438 (0.00422)
Jurisdictional Variables	Decatur	0.04500 ** (0.01685)	-0.00279 (0.01282)	-0.04704 (0.08729)	-0.13092 (0.08921)
	Franklin	0.04108 ** (0.01375)	-0.01483 (0.01047)	-0.27283 ** (0.07126)	-0.44481 ** (0.07282)
	Lawrence	0.01871 (0.01160)	0.02173 * (0.00883)	-0.23143 ** (0.06009)	-0.12484 * (0.06104)
	Perry	0.04545 ** (0.01169)	-0.02517 ** (0.00890)	-0.26172 ** (0.06059)	-0.10044 (0.06192)
	Pike	0.06223 ** (0.01320)	0.01296 (0.01005)	-0.49761 ** (0.06839)	-0.23199 ** (0.06989)
	Warren	0.08188 ** (0.01044)	0.00844 (0.00795)	-0.05459 (0.05411)	-0.11884 * (0.05530)
	Washington	-0.02761 * (0.01106)	-0.02939 ** (0.00842)	0.05887 (0.05729)	-0.69381 *** (0.05855)
	Wayne	0.05271 ** (0.01046)	-0.00092 (0.00796)	-0.28721 ** (0.05420)	-0.14527 ** (0.05538)
	_cons	4.42390 ** (0.03385)	4.55585 ** (0.02576)	1.52300 ** (0.17537)	1.86912 ** (0.17921)
	R^2=	0.1994	0.0359	0.1020	0.11027

$**p<=0.01$;$*p<=0.05$

†Indicates that the difference in the coefficients for foreclosures and non-foreclosures is significant at p<0.05

Figure 1: Percentage of Sold Properties Foreclosed in Marion County, Indiana, 2003-2006

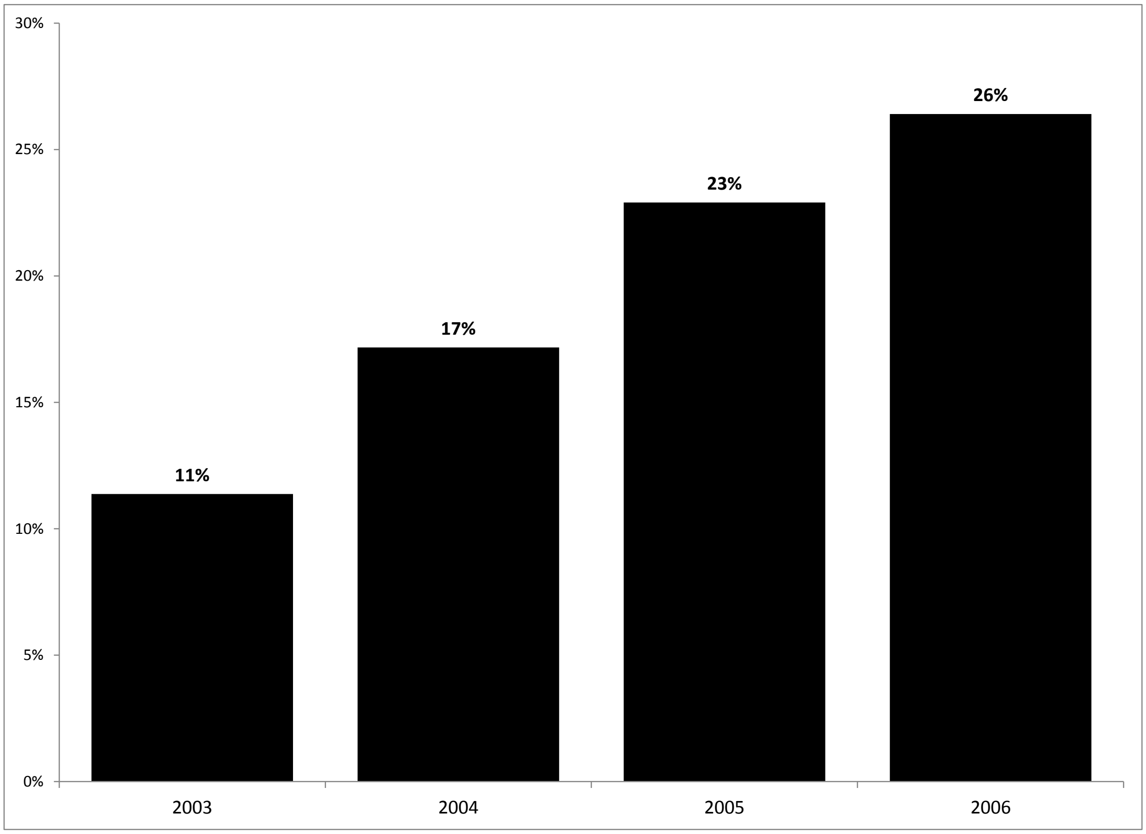
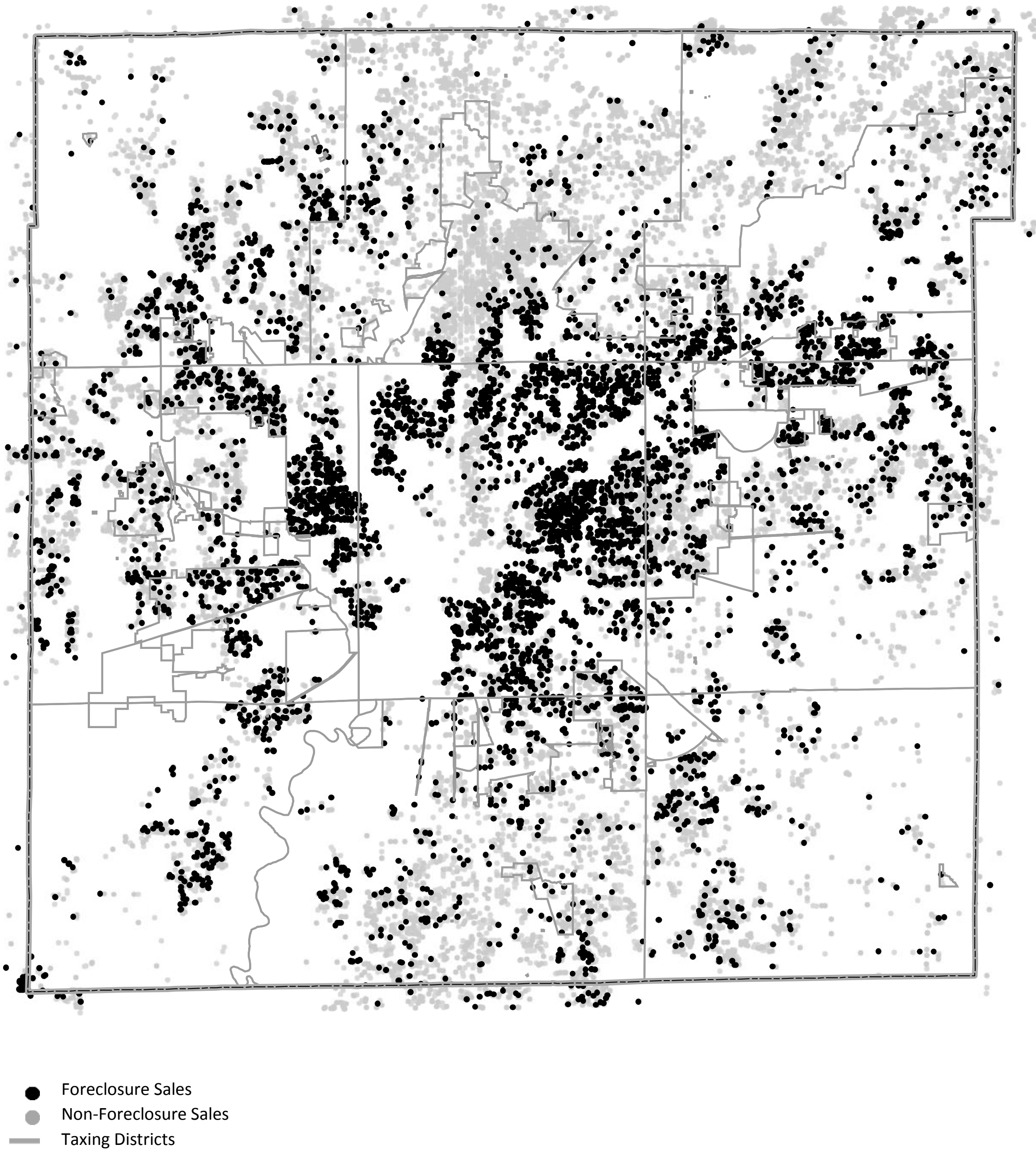


Figure 2: Foreclosure Sales and Non-foreclosure Sales, Marion County, Indiana, 2004-2005



[1]Based on data collected from the US Bureau of the Census, Census of Governments.

[2] The distinction between current-value-in-use and highest and best use essentially is a change in property classification. The change in use of one parcel would not directly affect the assessed value of other properties. The land use change would only affect the assessed value of the subject property, the aggregate assessed value within a given jurisdiction, and ultimately the nominal tax rate.

[3]For instance, a jurisdiction may assess properties on a three-year cycle with one-third of the real property parcels assessed sequentially each year.

[4] Dispersion is the inverse of uniformity. The farther AS_i is from AS_{mean}, the more AS_i is "dispersed" from the sample mean AS.

[5] Formally, all models may be adapted to test the null hypothesis that the relationship between foreclosure sales and the dependent variables is equal to the relationship between non-foreclosures sales and the dependent variables within *j* radius - H_0: β_{fj}(foreclosure) – β_{nj}(nonforeclosure) = 0 against H_1: β_{fj}(foreclosure) – β_{nj}(nonforeclosures) ≠ 0.The significance of the differential effect of foreclosures relative to non-foreclosures is determined by *t* (Wooldridge, 2003):

$$t = \frac{\beta_{nj} - \beta_{fj}}{se(\beta_{nj} - \beta_{fj})}$$

Where:

$$se\,(\beta_{nj} - \beta_{fj}) = \{se(\beta_{nj})]^2 + [se(\beta_{fj})^2 - 2s_{nfj}]\}^{1/2}$$

and

$$2s_{nfj} = Cov(\beta_{nj}, \beta_{fj})$$

The standard error of the difference between foreclosures and non-foreclosures is determined by defining a new parameter in the models: $\theta_z = \beta_{nj} - \beta_{fj}$. The models may be adapted by initially substituting $\beta_{nj} + \theta_z$ for β_{fj}. The formal equation for significance between foreclosures and non-foreclosures is: $Y = \beta_0 + [\beta_{nj} + \theta_z](\text{foreclosure})_{fj} + \beta_{nj}(\text{non-foreclose})_{nj} + \beta_k S_k + \beta_j L_j + \beta_h R_h + \beta_g T_g + e$. Since β_{nj} becomes a parameter for foreclosures and non-foreclosures, the equation may be rearranged by including the sum of non-foreclosures and foreclosures for β_{nj}. The parameter θ becomes isolated: $Y = \beta_0 + \theta_z(\text{foreclosure})_{zj} + \beta_{nj}(\text{foreclosure + non-foreclose})_{nj} + \beta_k S_k + \beta_j L_j + \beta_h R_h + \beta_g T_g + e$. With the new specification, θ is the parameter for the foreclosure effect and serves as an estimate of the difference between an additional foreclosure sale and non-foreclosure sale. Considering $\theta_{zj}$and β_{nj} together, β_{nj} is the estimate for the effect of non-foreclosed sales after taking into account all other variables, including foreclosed properties. The standard error for H_1 is directly estimated, which allows for the determination of level of significance: $t = \frac{\theta_z}{se(\theta_z)}$

[6] The next mass appraisal is scheduled for 2012.

[7] The comparable sales did not include foreclosure sales.

[8] Sale price is used as a proxy for market value.

[9] Total sales include foreclosure and non-foreclosures sales.

[10]Initially, ten variables were tested. The initial test included the number of foreclosures and non-foreclosures within 1/8 mile, 1/8 to ¼ mile, ¼ mile to ½ mile, ½ mile to ¾ mile, and ¾ mile to one-mile. The variables included in the model were empirically determined by testing whether or not the numbers of foreclosed properties within the radii rings were significantly different from each other.

[11] Open land refers to land on a parcel that is not covered by a home.

[12] The difference between 0.01333 and -0.00647 is equal to 0.0197. Since the difference of the coefficients is significant and the model is log-level, the difference represents a 1.97 percent.

Author Biography

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