Contemporary neighborhood housing dynamics in a mid-sized US city: the policy consequences of mismeasuring the dependent variable

Matthew J. Hanka\textsuperscript{a}, Joshua D. Ambrosius\textsuperscript{b}, John I. Gilderbloom\textsuperscript{c} \& Keith E. Wresinski\textsuperscript{c}

\textsuperscript{a} Department of Political Science and Public Administration, University of Southern Indiana, Evansville, IN, USA
\textsuperscript{b} Department of Political Science, University of Dayton, Dayton, OH, USA
\textsuperscript{c} Department of Urban and Public Affairs, University of Louisville, Louisville, KY, USA

Published online: 27 Mar 2015.

To cite this article: Matthew J. Hanka, Joshua D. Ambrosius, John I. Gilderbloom \& Keith E. Wresinski (2015): Contemporary neighborhood housing dynamics in a mid-sized US city: the policy consequences of mismeasuring the dependent variable, Housing and Society, DOI: 10.1080/08882746.2015.1020704

To link to this article: http://dx.doi.org/10.1080/08882746.2015.1020704

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Contemporary neighborhood housing dynamics in a mid-sized US city: the policy consequences of mismeasuring the dependent variable

Matthew J. Hanka\textsuperscript{a},*, Joshua D. Ambrosius\textsuperscript{b}, John I. Gilderbloom\textsuperscript{c} and Keith E. Wresinski\textsuperscript{c}

\textsuperscript{a}Department of Political Science and Public Administration, University of Southern Indiana, Evansville, IN, USA; \textsuperscript{b}Department of Political Science, University of Dayton, Dayton, OH, USA; \textsuperscript{c}Department of Urban and Public Affairs, University of Louisville, Louisville, KY, USA

(Received 6 January 2014; accepted 17 December 2014)

This paper analyzes median assessed residential property values using three different operationalizations of a tract-level dependent variable for a mid-sized US city: Louisville, Kentucky. We estimated the impacts of accessibility, socio-demographics, and housing characteristics as well as three policy interventions (HOPE VI, historic preservation districts, and university–community partnerships) on median assessed values and changes to them over the 2000–2006 housing bubble. Our interpretation of models employing the three different operationalizations leads to different conclusions about neighborhood health and the efficacy of policy programs. Conventional operationalizations employed by advocates, such as looking at medians or raw dollar changes in median values, are likely to find that policy interventions have less of an impact compared to measuring recent percent changes in property values. Thus, we provide a methodological contribution that shows that percent changes should accompany traditional analysis in capturing the effects of contemporary policy interventions. Mismeasuring neighborhood housing markets has played a role in prematurely concluding that targeted policy programs in neighborhoods are ineffective. Based on our analysis, we invite academics and policy-makers to rethink contemporary neighborhood housing dynamics.

Keywords: housing policy; neighborhoods; HOPE VI; historic preservation; university–community partnerships

Introduction

The Greater Louisville Project (GLP), a research and advocacy initiative created in 2003 at the time of the city-county merger in Louisville, Kentucky, included a map of dollar increases in neighborhood median housing values from 2000 to 2005 in its 2007 Competitive City Report. This map, color coded by census tract across consolidated Louisville Metro, showed that mostly outer suburban communities in the city-county’s upper-income, eastern edge experienced the greatest benefits of the housing boom – coded as gains of more than $35,000 in median values (Greater Louisville Project, 2007, p. 8).\textsuperscript{1} This map further showed that a small portion of “revitalized” communities in the African-American western neighborhoods experienced gains in their medians between $16,000 and $22,999 with several experiencing gains over $23,000. This map, however, showed that much of western Louisville experienced gains below $16,000, the lowest bar.

*Corresponding author. Email: mjhanka@usi.edu

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As a local newspaper account indicated in the same year, however, analyzing percentage increases – rather than dollar gains – in median property values across neighborhoods provides a wholly different picture of which areas experienced the “biggest gains” (Green, 2007). Many urban communities close to downtown, including those in majority African-American tracts, saw percentage increases up to double the neighborhood medians – even if the raw dollar increases were slim compared to the expensive suburbs. Several cases of extreme appreciation in median values were mostly due to targeted public investments, in league with private partners, to turn around failing communities. We argue that viewing and analyzing percentage increases in median values – a good proxy for neighborhood-level return on investment – in addition to other indicators of housing value can portray a better sense of comparative neighborhood health.

This study, inspired by the contrary accounts mentioned earlier, analyzes how different operationalizations of the dependent variable in housing studies – Median Assessed Residential Property Value – lead to vastly different conclusions about neighborhood housing market performance. We construct several specifications of three neighborhood-level regression models – predicting neighborhood median values, dollar changes in medians, and percentage changes in medians, to illustrate that the effects of various independent variables change depending on the outcome chosen by the analyst. We group our independent variables into four categories: accessibility, socio-demographic, housing, and public policy indicators. To be consistent with the earlier findings by the GLP, we chose to analyze tract-level data for Louisville Metro during the housing bubble period, 2000–2006. Other research has identified this period and the following two years, 2007–2008, as approximations of distinct periods of boom and bust (Ambrosius, Gilderbloom, & Hanka, 2010; Gilderbloom et al., 2012). In our case, depending on the model chosen – medians, dollar changes, or percent changes – some independent variables are statistically significant or insignificant, and have different signs and/or coefficient magnitudes.

As a result, an analyst – or advocate, in the case of the GLP – must look at different indicators of policy success to adequately gauge resulting changes in the housing market. The public policies included as independent variables in our models are designation as: (1) a historic preservation district, (2) a participant in the HOPE VI program, or (3) the site of a federally-funded university–community partnership. HOPE VI is a federal program that has been implemented in localities throughout the country (albeit with variations in impacts), while the other two policy interventions are locally-specific policies.

Louisville was chosen as the case under study for various reasons. Firstly, Louisville is an interesting and desirable case for geographic, social, structural, and political/policy reasons (see Ambrosius et al., 2010). Louisville is a mid-sized city long known as the “gateway from the North to the South” due to its border between the south and midwest regions, known locally as Kentuckiana (McMeekin, 1946, p. 256). The American Midwest, in which Louisville’s nearby sister city, Cincinnati, Ohio, is firmly placed, is recognized as the most demographically representative region of the county (Barlow, 2004). Louisville has a fairly representative minority population – one-third in the former central city and roughly one-fifth in consolidated Louisville Metro as of the 2000 US Census. Louisville is a traditional monocentric city in the Chicago School vein with the division between urban and suburban identified by concentric inner and outer beltways, the Watterson Expressway (I-264) and Gene Snyder Freeway (I-265), respectively (Ambrosius & Gilderbloom, 2015; Ambrosius et al., 2010; Louisville-Jefferson County Metro, 2006). Despite increasing economic development at the fringe along the outer
beltway, Louisville is still a relatively monocentric city in the economic sense too, meaning it has a singular downtown business district. The lone central business district (CBD) census tract accounts for nearly 52,000 jobs, or 13% of all employment in the county, based on 2000 Census data. Louisville also has a semi-autonomous housing market, in a geographic sense, which makes it an ideal candidate for a case study because all other major cities are at least 75 miles away (Ambrosius et al., 2010).²

The city is moreover known for its recent political and policy innovation. The former city of Louisville merged with surrounding Jefferson County in 2003 to form a consolidated city-county known as Louisville Metro (Savitch & Vogel, 2004). We use data for the consolidated metropolitan county rather than the former city or the Louisville-Jefferson County, Kentucky-Indiana, Metropolitan Statistical Area (MSA), which includes the adjacent exurban and rural counties. The consolidation has made it easier to obtain data for the entire city-county region. Louisville has traditionally been divided into several distinct sub-regions, including the poorer, African-American neighborhoods in the west, wealthier and middle-class White neighborhoods to the east, and working class southern neighborhoods. Conventional wisdom holds that eastern Louisville features the best performing housing submarkets while western Louisville is known for its impoverished neighborhoods. The older middle-class suburbs likely lie somewhere in between, while the newer, outer suburbs are thought to be some of the best performing submarkets. The Louisville Metro government has attempted to alter perceptions of traditional sub-regions, arguing that the new consolidated city-county should be viewed as three distinct housing submarkets – inside the inner beltway, between the beltways, and outside the outer beltway (Louisville-Jefferson County Metro, 2006; also see Ambrosius et al., 2010).

Recent policy innovations, within the urban core and especially the African-American western communities, along with other contemporary dynamics may have altered the performance of these housing submarkets.

Secondly, we believe that much can be learned from Louisville and other mid-sized cities that have a population approximately between 500,000 and 1,000,000 people. While much has been published on megacities with populations above (or well above) a million people, including New York City, Los Angeles, and Chicago, much less focus has been given to mid-sized or middle-weight communities. As noted earlier, we believe that analyses of the “Louisvilles” will generate findings more consistent with most US communities than studies of megacities – despite the presence of unique features like consolidation.³

Finally, Louisville was less affected by the recent housing bubble than many other cities according to the local Property Valuation Administrator (PVA; Lindauer & Hunt, 2008). While Louisville did appreciate quite a bit during the boom years – which our analysis shows – the appreciation in Louisville was not nearly as extreme as some other areas where the positive changes were quickly undone when the bubble burst. In other words, our findings may again be more representative of “typical” communities that appreciated during the bubble but not as extremely as some of the Sunbelt cities of the south and west. When compared to its 14 peer cities over the first five years of the bubble, Louisville’s median home value continued to rank well below the Sunbelt cohort, including Jacksonville, FL, Charlotte, and Raleigh, NC (Greater Louisville Project, 2007). In fact, Louisville’s median value fell two spots in the ranking in the years since 2000. Louisville also escaped the worst of the depreciation and foreclosure crisis that followed, unlike some of its peers and most neighbors to the north in Ohio and Michigan. Louisville is notably absent from the “100 Hardest-Hit Cities” list, as well as the metro area and ZIP code lists, by negative equity in the recent Underwater America report released by the Haas Institute (Dreier, Bhatti, Call, Schwartz, & Squires, 2014).
In sum, this paper argues that analysts and advocates alike should use a cluster of indicators to assess neighborhood housing conditions and the impacts of targeted policy interventions. The paper proceeds as follows. This introduction is followed by a literature review of the theoretical background, traditional predictors of housing values, and select public policies. The third section deals with the data sources and the methodology used in this research. The fourth section presents and discusses results of mapping, descriptive statistics, and the regression models. To conclude the paper, we present policy implications and conclusions in the final two sections.

Literature review

Theoretical background

Neighborhood change has been analyzed in the urban studies literature for decades. Galster, Cutsinger, and Lim (2007) differentiate among three clusters of theories: (1) early theories of neighborhood change, such as the invasion-succession model, the life-cycle model, the demographic/ecological model, the socio-cultural/organizational model, the state model, the political economy model, and the social movements model, among others; (2) predictive neighborhood change models based on regression analyses that focus on specific indicators, such as population density, income or social class, homeownership rates, female headship rates, and racial and ethnic composition changes, among others; and (3) predictive neighborhood change models based on regression analyses that focus on “threshold effects to determine how exogenous variables are associated with changing neighborhood outcomes” (Galster et al., 2007, p. 168).

Our study falls into the second theoretical cluster. Our focus is on property values as an indicator of neighborhood change, a dependent variable that is explained by the initial conditions of several independent variables. Below we discuss traditional predictors of housing values, differentiating among accessibility, socio-demographics, and housing characteristics.

Traditional predictors of housing values

Burgess (1925, p. 61) classically stated that variations in land values are “perhaps the best single measure of mobility, and so of all the changes taking place in the expansion and growth of the city.” In the United States, property values typically include the price or estimated value of both the land and built structure(s) on it (Archer, Gatzlaff, & Ling, 1996). Although the literature indicates the importance of supply-side factors (i.e. factors related to the construction or provision of homes) and demand-side factors (i.e. factors related to the homebuyer and community) (see Colton, 2003; Kain & Quigley, 1970), our paper focuses on the demand-side factors, as these factors are easily available to us, such as (a) accessibility, (b) socio-demographics, and (c) housing characteristics. Some of our variables, nonetheless, imply supply factors – such as our proxy for new construction. These factors are justified and discussed in detail below and they are also part of the quantitative models discussed in the methodology section.

Accessibility

Location and accessibility influence households’ commuting costs and disposable income, therefore affecting property values. Monocentric urban models (e.g. Alonso, 1964;
Mills, 1972; Muth, 1969) predict declining rent gradients per unit of land [sic] and suggest that the CBD is the point of maximum accessibility. Other advantages, in the simplest version of the model, include the fact that the CBD is the only location of employment and retail (Case & Mayer, 1996; Jackson, 1979). Therefore, households who have the least to spend on transportation tend to locate near the CBD in high density housing – to reduce per unit cost – while those with higher incomes can afford to choose to spend it on more land at the edge of the city, with the longer commutes that entails. The difference in costs – primarily transportation costs – associated with the two locations influences the difference in property values.

Over the past several decades, urban structure has changed from a monocentric to a polycentric form in many cities in the United States, although Louisville has retained a largely monocentric character (Ambrosius et al., 2010). In general, there is a high correlation between property values and proximity to amenities – although extreme proximity to a perceived amenity can become a disamenity. For example, while proximity to an airport is a positive amenity, immediate proximity to an airport is a negative amenity due to air/noise pollution and traffic congestion (Anderson & Crocker, 1971; McMillen, 2004; Tomkins, Topham, Twomey, & Ward, 1998). We included the variables Adjacency to the Airport (which is located between the inner and the outer beltways in a long, vertical tract that is itself excluded from analysis), Location Inside the Inner Beltway, and Employment Density in our quantitative models to capture accessibility.

Socio-demographics and related factors

High demand for properties, such as the number of households bidding on a house, causes property values to increase, since the supply of the land curve is upward sloping (i.e. increasing; see Browne, 2000; Logan & Molotch, 1987; Manning, 1986, 1989; Ozanne & Thibodeau, 1983; for mixed results). Demand itself is difficult to measure, but proxies can be used. Some may equate high population and housing density with high demand for housing. Dense neighborhoods oftentimes provide access to amenities in walkable distance, such as sports and entertainment facilities (Appelbaum, 1978; Gilderbloom & Appelbaum, 1988; Logan & Molotch, 1987). We included the variable Population Density in our models.

Many studies argue that the racial and ethnic composition of a neighborhood has an influence on property values and their appreciation (see Hoyt, 1939, among others). The literature differentiates between a static racial composition and a dynamic, changing one. With respect to a static racial composition, some studies found a negative effect of non-White racial composition in the neighborhood on property values (Harris, 1999; Hayduk, 2003; Massey & Lundy, 2001; McEntire, 1970; Saiz, 2007; Sutker, Gilman, & Plax, 1974). Other more recent studies argue that there is either no effect or a positive effect of the non-White racial composition in a neighborhood on property values (Ambrosius et al., 2010; Ellen, 2000; Kim, 2000; Ottaviano & Peri, 2006; Ross & Turner, 2005; Sykes, 2003). With respect to a dynamic racial composition, there is a threshold issue called the “tipping point” or a similar term (see Farley, Schuman, Bianchi, Colasanto, & Hatchett, 1978; Schelling, 1978; among others). We included the variable Proportion of Non-White Residents in our models. This is a static indicator that differentiates between majority White and majority non-White neighborhoods due to historical factors. Reliable data on racial or ethnic transition in neighborhoods is only available for the 10-year Census period at the tract level.
Some sociologists have hypothesized that neighborhoods with high proportions of same-sex households are characterized by appreciating property values (Ambrosius et al., 2010; Castells, 1983; Castells & Murphy, 1982; Florida, 2002). These neighborhoods are oftentimes gentrified or gentrifying neighborhoods that are within walking distance to amenities (Helms, 2003). Also, many male same-sex households are thought to possess more disposable income because of the lack of children and, therefore, have more money and incentive to spend on housing improvements (Black, Gates, Sanders, & Taylor, 2002). We incorporated the variable Proportion of Same-Sex Households into our models.

Neighborhood incomes are related to neighborhood house prices in a positive fashion. Typically, the higher the median household income is, the higher the median property value (Gilderbloom & Appelbaum, 1988). Ball (1973, p. 231) points out that valuations of housing characteristics by individuals are highly dependent on the individual’s income, stating that “the average valuation by the average consumer in a city and the price coefficient of an attribute will depend on the absolute level of income and its distribution.”

We included the variable Median Household Income in some of our models, following Li and Rosenblatt (1997) and Kim (2000), but not in others because the variable is endogenous and varies collinearly with median housing values.

Some researchers have also examined how neighborhood unemployment can affect housing values (Clapp & Giaccotto, 1994). If a large proportion of potential buyers are without steady employment and thus income, high-priced homes will linger on the market and sellers are forced to withdraw or lower prices. Since the collinearity between the unemployment rate and neighborhood incomes was relatively low, we included the variable Unemployment Rate, i.e. the proportion of those in the labor force who were without work yet actively seeking, in our model.

Public safety, a local public good, is difficult to define, and, thus, difficult to measure. In many cases, the inverse is taken. An increase in the level of public safety can be interpreted as a decrease in the probability that an individual will become a victim of a property or violent crime. Although studies use different variables as proxies for public safety, high crime is almost universally found to negatively impact property values – or the inverse, that low or decreasing crime positively impacts values (Burnell, 1988; Case & Mayer, 1996; Hellman & Naroff, 1979; Kim, 2000; Lynch & Rasmussen, 2001; Schwartz, Susin, & Voicu, 2003; Taylor, 1995). We included the variable Crime Level in our quantitative model, which is explained later in detail.

Housing characteristics

Researchers have also hypothesized relationships between neighborhood property values and other community-level housing variables. The construction of new housing units typically causes housing prices to increase as builders attempt to recoup construction costs (Ambrosius et al., 2010; Berry & Hall, 2005; Keating, 1998; Mee, 2002). The net difference in neighborhood units between two points in time is a good proxy for new construction and demand for housing (Ambrosius et al., 2010). Thus we included the variable Percentage Change in Number of Housing Units in our models.

Property values are also influenced by structural variables of the unit such as age. Results are complex since the relationship is probably non-linear and non-monotonic (Appraisal Institute, 2001; Cannaday & Sunderman, 1986; Chinloy, 1978; Goodman & Thibodeau, 1997; Hotelling, 1925; Hulten & Wykoff, 1981; Lowry, 1960; Palmquist, 1979; Rubin, 1993). On the one hand, the negative coefficient of age can be interpreted as depreciation, i.e. decreased productivity and more costly maintenance; while on the other
hand, a positive coefficient of age can be interpreted as a premium, or vintage, effect (Clapp & Giaccotto, 1998; Malpezzi, Ozanne, & Thibodeau, 1987; Randolph, 1988). We included the variable Median Housing Age in our modeling.

Conventional thinking among researchers holds that vacancy rates impact property values in a negative fashion: high vacancies are a product of low demand for property (Appelbaum, Dolny, Dreier, & Gilderbloom, 1991; Ball, 1973; Deng, Gabriel, & Nothaft, 2003; Gabriel & Nothaft, 2001; Gilderbloom, Appelbaum, Dolny, & Dreier, 1992; Lai, Wang, & Yang, 2007). Other recent scholarship has found positive effects of vacancy rates in 2000 on property value changes over the boom period (Ambrosius et al., 2010). This effect could indicate a supply of properties for redevelopment in the older neighborhoods of the urban core. We included the variable Proportion of Housing Units Vacant in our models. There is also agreement that high proportions of rental homes impact property values in a negative fashion (Beer, Kearins, & Pieters, 2007; Wood, Watson, & Flatau, 2006). This is generally attributed to the poorer upkeep of non-owner occupied units compared to units that are owner-occupied. Thus, we added the variable Proportion of Rental Units into our quantitative models.

Public policy interventions
Researchers also have found that targeted housing policy interventions can increase property values at the neighborhood level (Ambrosius et al., 2010; Gilderbloom, Hanka, & Ambrosius, 2009). As Tiebout (1956, p. 416) in his seminal article noted, “while the residents of a new government housing project are made better off, benefits also accrue to other residents of the community in the form of the external economies of slum clearance.” Efforts at urban renewal and revitalization such as the destruction of outdated public housing and its replacement with mixed-income developments, which is the hallmark of the HOPE VI program, are oftentimes assumed to be positive externalities for surrounding communities (Bair & Fitzgerald, 2005; Hanka, Gilderbloom, Meares, Khan, & Wresinski, 2015; Zielenbach & Voith, 2010; for an alternative opinion, see Rosin, 2008). Thus, we use the (dummy) variable HOPE VI Neighborhood in our quantitative model (Bair & Fitzgerald, 2005).

Another targeted housing policy intervention is a local university–community partnership. Targeted investments with the support of a local university tend to better neighborhood image and result in tangible property improvements (Ambrosius et al., 2010; Gilderbloom & Mullins, 2005; Perry & Wiewel, 2005; Rodin, 2007). We hypothesize that they have a positive effect on property values and include the variable University–Community Partnership Neighborhood in our model.

A third targeted housing policy intervention is historic preservation designation, which has been well researched. Most studies also find a positive correlation between neighborhoods with historic preservation ordinances and property value increases (Coulson & Lahr, 2005; Coulson & Leichenko, 2001; Ford, 1989; Gilderbloom et al., 2009; Haughey & Basolo, 2000; Leichenko, Coulson, & Listokin, 2001; Rypkema, 1997; Shipley, 2000). Nearby the University of Pennsylvania, property values likely increased because the faculty was attracted to low-interest loans provided by the university (Rodin, 2007). However, in limited cases, historic preservation efforts have caused a loss in property appreciation (Asabere, Huffman, & Mehdian, 1994). We call our included variable Historic Preservation District, which consists of eight locally controlled preservation districts that cover large portions of 10 census tracts (Ambrosius et al., 2010; Gilderbloom et al., 2009). All 10 tracts, coded with a dummy variable, are within the inner beltway. This method is described in greater detail in the following section.
Data and methods

Data, variables, and hypotheses

The geography of our study is Louisville Metro and our unit of observation is the census tract. While it is customary to conduct housing studies at the individual parcel level, we followed several others in conducting a neighborhood-level equivalent of a hedonic estimation. Other studies have used census blocks, block groups, or tracts to approximate neighborhoods so that reliable census data can be paired with property value data (e.g. Ambrosius et al., 2010; Bair & Fitzgerald, 2005; Kim, 2000; Shultz & King, 2001). Shultz and King (2001) found that, while smaller census geographies are preferable, analysis at the census tract level does not differ much in model fit or the coefficient estimates. Kim (2000, p. 14) further adds that using, “census tracts as the analytical unit” is useful because “it is small enough to capture difference in housing price behavior and large enough to have adequate number of observations.” Kim continues, “Moreover, adopting census tracts as the basic neighborhood unit enables us to use other data collected by census tracts.” We chose to conduct this study at the tract level for two reasons. Firstly, we believe that the 2000 Census tracts in Louisville approximate locally-defined neighborhoods better than the smaller geography. Secondly, we followed the GLP and other local policy-makers and advocates who publicly describe the condition of Louisville’s neighborhoods by analyzing tracts (Greater Louisville Project, 2007). Our study contains 170 tracts although we limit the final analytical sample to 167.

Our dependent variable is Median Assessed Residential Property Value and derivations thereof. We operationalized this variable in three different ways: (1) Median Assessed Residential Property Value, 2006; (2) Raw Dollar Change in Median Assessed Residential Property Value, 2000–2006; and (3) Percent Change in Median Assessed Residential Property Value, 2000–2006. For these variables, data on all residentially-zoned properties in Louisville Metro for the years 2000 and 2006 was collected from the Jefferson County PVA and geo-coded to census tracts by the Kentucky State Data Center using the Louisville/Jefferson County Information Consortium’s (LOJIC) Geographic Information System. Median assessed values by census tract were calculated from the geo-coded parcel data. For the regression analysis, we converted the medians to thousands of dollars for better interpretation. In standard practice, the median was chosen over the mean because it is not biased upward by the high-valued outliers that exist in several neighborhoods – particularly the outer ring suburbs. We also used this data to construct the Percentage Change in Number of Housing Units independent variable by calculating the change in total residential units per tract reported by the PVA from 2000 to 2006.

Median assessed residential housing values better approximate true market values than the self-reported median values reported in the Census. We believe that, in Louisville and perhaps other places, the assessment practices in place make these assessed values approximate true market values (Gilderbloom, Hanka, & Ambrosius, 2012). According to the Jefferson County PVA, property assessments are done approximately every four years, and their goal is to conduct assessments more frequently – particularly given the housing slowdown. Kentucky Revised Statute 134.385 requires that local property assessments be at least 80% of the “fair market value” and provides for state oversight in case of a discrepancy between the assessment and market value. As illustrated in LaCour-Little and Green (1998), our rationale for using assessed values is explained by the following logic:
\[ P = V + \varepsilon_1; \]
\[ A = V + \varepsilon_2; \]
\[ E[\varepsilon_1] = E[\varepsilon_2] = 0; \]
\[ E[A - P] = 0, \]

where \( P \) is selling price, \( A \) is assessed value, \( V \) is market value, and \( \varepsilon_1 \) and \( \varepsilon_2 \) are the error terms.

In other words, we assume that price and assessed value are both proxies for true market value and that the expected error terms equal zero. A study of Louisville found that assessments were on average 86% of sales prices and that there is no significant variation among neighborhoods based on socio-demographic and other indicators (Gilderbloom, Hanka, & Ambrosius, 2012). Nevertheless, there is the public perception of assessors drastically undervaluing expensive, suburban properties and overvaluing cheap, urban ones (e.g. Harris & Lehman, 2001). The previous Louisville study, however, shows that any bias in our case is relatively equal across all neighborhoods (Gilderbloom, Hanka, & Ambrosius, 2012). We thus assume that assessed values, the basis of our dependent variable, are a good proxy for market values (also see Clapp & Giaccotto, 1992).

Another reason we used median assessed value for each tract is that it allows every property within the tract to be included in the analysis through the calculation of the median. Median sales prices neglect appreciation in properties which have not sold but will be captured in repeat assessments.

Pollakowski (1995, p. 378) correctly notes that “using median selling prices to follow a housing market can be misleading because the composition of sales may vary over the cycle.” This criticism does not apply to median assessed values because all assessed properties in the population were included in the calculation of the median. The construction of new units or the demolition of old ones were the only factors that change the composition of cases in each neighborhood.

Assessed values are ideal for our analysis period because the typical lag between assessments of three to five years is overcome by our seven-year analysis period. Every property in our sample has been reassessed at least twice over the seven years analyzed. In addition, assessed values are regularly adjusted to the sales price for homes which have sold in the previous year (Gilderbloom, Hanka, & Ambrosius, 2012). Clapp and Giacotto (1992, p. 305) concluded that assessed values and repeat sales both “give substantially the same estimates of price trends over a 5–7 year period.” Adjusting for inflation was unnecessary because we are comparing property value increases within a single metropolitan area that experienced the same overall level of inflation. If we instead calculated increases based on real dollar values, the findings for particular neighborhoods would be identical but with smaller coefficients. Our analysis period ranges from 2000 to 2006, which covers the seven years when the United States experienced a house price bubble (Shiller, 2007). However, during that time, the Louisville metropolitan area experienced only modest increases in house prices (Lindauer & Hunt, 2008). Lindauer and Hunt (2008, p. 2) of the local PVA wrote that Louisville had “a resilient market without extremes in yearly value appreciation” that “was seeing steady 2–5% yearly increases” over the housing boom rather than the double digit appreciations of the Sunbelt and some parts of the Midwest.
Regarding the independent variables, we relied on data provided by: (1a) the US Bureau of the Census’s 2000 Census; (1b) the US Bureau of the Census’s 2000 Transportation Planning Package; and (2) the Louisville Metro Police Department (LMPD). We relied on source (1a) for the following variables: Socio-Demographics (Population Density, Proportion of Non-White Residents, Proportion of Same-Sex Households, Median Household Income, and Unemployment Rate) and Housing Characteristics (Median Housing Age, Proportion of Housing Units Vacant, and Proportion of Rental Units). We drew from source (1b) for the calculation of Employment Density of the Accessibility category and from source (2) for the calculation of the Crime Level of the Socio-Demographic category.

We used standard calculations for each of the variables drawn from the Census. Population density is the number of total persons residing in each square mile of census tract area. The proportion of non-White residents is the ratio of residents identifying as anything other than “White only” to all residents of each tract. The proportion of same-sex households is the sum of male same-sex households and female same-sex households divided by all households per census tract. Median household income was included in thousands of dollars to ease the interpretation of the coefficient (i.e. the effect of an increase of one is now tied to an increase of $1000 rather than an increase of $1). The unemployment rate is the proportion of those in the labor force who were without work yet actively seeking employment. Median housing age is the median age of the housing stock in the census tract calculated by subtracting the median year built from the year 2000. Proportion of housing units vacant is the proportion of housing units in the census tract that were vacant as of the 2000 Census. Proportion of rental units is the proportion of housing units in the census tract that are occupied by a tenant as opposed to the homeowner. Employment density is calculated similarly to population density by dividing the total number of jobs per census tract by the land area in square miles. This is a proxy for proximity to employment because it does not factor in employment in adjacent tracts.

Data for total crimes in the property and violent categories for each of the eight police districts were made available by the LMPD for the year 2004. Our intention was to collect crime data for the same year as the 2000 Census variables. This was not possible because prior to the 2003 consolidation, the county was served by numerous police agencies and no countywide data were accessible. 2004 was the first year for which countywide data were collected and made accessible for analysis. We chose to sum these two categories because they are the most important concerns for current or potential homeowners. We calculated district rates per 100,000 residents using 2000 population counts from the census aggregated to the districts. Because police districts each include an average of just over 20 tracts, and rates per district are not evenly distributed across each constituent tract, we decided to create an ordinal scale of crime per district and apply it to all of the tracts for that district. Because of the distributed values of the crime rates, and the fact that several districts had very similar rates, we chose to order tracts from “1” (low) to “5” (high). For examples, a score of “1” corresponds to less than four violent or property crimes per 100,000 residents while a score of “5” represents over 16 crimes per the same number of residents. Thus, the variable Crime Level represents whether a neighborhood is located in a police district with low, moderately-low, moderate, moderately-high, or high levels of violent and property crimes. Given the limitations of the data, this coding scheme was the best option available that comports with the LMPD’s strategy of grouping similar neighborhoods (in terms of criminal activity) together in the districts.

In terms of accessibility, we created two additional independent variables from observation: Adjacency to the Airport and location Inside the Inner Beltway. Adjacency
to the airport is a dummy variable – census tracts that are adjacent to the airport tract (011901) were coded as “1” and tracts that were not adjacent to the airport were coded as “0.” Inside the Inner Beltway is also a dummy variable – tracts that are majority located within Louisville’s Watterson Expressway (I-264), the inner beltway, were coded as “1” and tracts that are located outside of the inner beltway are coded as “0.” These variables approximate the effects of neighborhoods being located in the immediate proximity of the airport or in the urban center of Louisville and near the CBD.\(^6\)

With the exception of crime and the geography-based variables, all are measured at the start of our analysis period (2000) and thus control for “initial conditions” at the beginning of the housing bubble (Kim, 2000, p. 23). In other words, our model estimates appreciation over the seven-year analysis period given neighborhood conditions at the base of the period. One can only predict the future with reference to the past. For the models predicting the 2006 median value, we used 2000 Census data as the best tract-level proxies of the true 2006 values available. Because all independent variables remain the same for all model specifications, we can directly compare each variable’s effects.

To represent the select policy interventions, we created a series of three dummy variables (a) HOPE VI Neighborhood, (b) University–Community Partnership Neighborhood, and (c) Historic Preservation District Neighborhood. HOPE VI and University–Community Partnership are applied to two additional neighborhoods, Park DuValle (tract 001400) and Russell (002400), respectively (Ambrosius et al., 2010; Gilderbloom et al., 2009; Gilderbloom & Mullins, 2005; Hanka, 2009). The Park DuValle neighborhood was the site of a $237 million public–private infusion to transform 1116 public housing units known as Cotter and Lang Homes into a New Urbanist, mixed-income community with both rental and owner-occupied units (Hanlon, 2010). The early phases began in the late 1990s and were mostly completed during the analysis period for this study. Some additional phases were completed by 2008 and off-site developments continue (Hanlon, 2010). Other Louisville HOPE VI sites, including Clarksdale and Sheppard Square, were funded and completed in the period beyond our years of analysis and do not warrant inclusion in this present study.

The effort to revitalize the East Russell neighborhood began in the mid-1990s and was mostly complete by the beginning of this analysis period. The effort was spearheaded by the University of Louisville’s Housing and Neighborhood Development Strategies (HANDS) program and the Center for Sustainable Urban Neighborhoods (SUN; Gilderbloom & Mullins, 2005). The program injected over $2.1 million into the neighborhood, including a $1.5 million US Department of Education grant and matching local funds and in-kind contributions, to revitalize or recreate its housing. City View Park (003000) was also the site of university–community intervention, but it is omitted from analysis as part of the CBD due to inadequate PVA data.

The historic districts were identified by referencing the list of districts provided by the Louisville Metro Historic Landmarks and Preservation Districts Commission. The county has nine preservation “districts.” West Main Street – a commercial district in the CBD covering few properties – and two suburban lower-class cities with independent review bodies are omitted from analysis. Thus, we geo-reference the six remaining Metro Landmarks Commission districts in residential areas to the census tracts that contain these districts. This dummy designation is applied to 10 census tracts around the downtown.

Because these interventions do not apply to every property in the labeled census tracts, and our method does not control for the implementation time periods, the inclusions of these variables captures the effects of having one of these interventions located within the neighborhood. These dummy variables represent a basic attempt to pull the effects of these
interventions out of the other independent variables’ coefficients – this is the reason we present each regression model with and without these dummies on the right hand side – rather than a pure attempt at evaluation. The coefficients are meaningful estimates of dollar and percentage changes due to these interventions, but we acknowledge that other methods – such as using individual properties, smaller Census geography, spatial lags, or time series analysis – could provide more precise estimates. Nonetheless, our method goes beyond the simple claims made by advocates and displays clear differences in interpretation depending on the housing outcome of choice.

Table 1 lists our hypothesized relationships between the three dependent variables (one per model) and the various independent variables. We indicate the hypothesized relationship with a plus (+) or minus (−) sign. We use two signs (+/−) to indicate unknown relationships.

Table 1. Hypothesized relationships.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacency to the Airport</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Location Inside the Inner Beltway</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Employment Density</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Demographics/socio-economics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Density</td>
<td>+/-</td>
<td>+/-</td>
</tr>
<tr>
<td>Proportion of Non-White Residents</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Proportion of Same-Sex Households</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Crime Level</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage Change in Number of Housing Units</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Median Housing Age</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Proportion of Housing Units Vacant</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Proportion of Rental Units</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td><strong>Select public policies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hope VI Neighborhood (Dummy)</td>
<td>−</td>
<td>+</td>
</tr>
<tr>
<td>University–Community Partnership Neighborhood (Dummy)</td>
<td>−</td>
<td>+</td>
</tr>
<tr>
<td>Historic Preservation District (Dummy)</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
relationships in which the most likely theorized direction is listed first. A question mark (?) indicates relationships that we are unsure about or that may have become non-significant over our contemporary analysis period.

**Methods**

Before we model the data, we produced a series of maps to visualize the patterns present in the housing value data. We then constructed eight Ordinary Least Squares (OLS) regression models. While previous analysis of Louisville housing markets has used more advanced spatial modeling, we chose to present the simple OLS models here because compensating for spatial dependence does not greatly alter the directions, significance, or magnitudes of the independent variables (see Ambrosius et al., 2010). We chose to not log the dollar dependent variables to allow for better interpretations of the coefficients. In the included models, we regressed the independent variables on our three dependent variables: Median Assessed Residential Property Value, 2006 (in thousands of dollars; specifications 1–4); Raw Dollar Change in Median Assessed Residential Property Value, 2000–2006 (in thousands of dollars; specifications 5–6); and Percent Change in Median Assessed Residential Property Value, 2000–2006 (specifications 7–8). Our use of the appreciation rate as a neighborhood-level dependent variable in the final two OLS specifications follows past scholarship (Ambrosius et al., 2010; Kim, 2000).

In specification 1, we included all independent variables except median household income and the three select public policy variables. In specification 2, we included all independent variables except median household income. Specification 3 contained all independent variables except the three select public policy variables and specification 4 contained all independent variables. In specification 5, we included all independent variables except the three select public policy variables and we add these back into specification 6. Specifications 7 and 8 are similarly presented without and with the policy variables. Specifications 4, 6, and 8 are directly comparable “full” models across the three dependent variables with all independent variables included. All models were tested for multicollinearity with no tolerance scores below the traditional cutoff of 0.20. The models with income included came closer to this boundary.

**Results and interpretation**

We initially mapped the housing value data (e.g. the three dependent variables) to visualize geographic patterns across Louisville Metro and theorize how they are each affected differently by neighborhood conditions and policy interventions. Figures 1–3 map, respectively, neighborhood median values for 2006, raw dollar increases in the median from 2000 to 2006, and percentage increases in the median from 2000 to 2006. Visual inspection of these maps makes several conclusions clear. For one, Figure 1 shows that the eastern part of the urban area and the eastern outer ring census tracts boast the highest median values—many of which exceed $200,000. All of the African-American western neighborhoods feature medians below $70,000. The inner ring and southern portions mostly exhibited modest values near the community-wide median of just over $100,000. Second, Figure 2 indicates that similar patterns are evident when looking at seven-year dollar differences. This map extends the GLP map of 2000 to 2005 dollar gains out to 2006 to capture the fullness of the boom years in Louisville (Ambrosius et al., 2010; Greater Louisville Project, 2007). Again, the eastern outer ring displays the highest benefits of appreciation. Many of these communities experienced increases in their
medians from $60,000 to over $85,000 over the seven-year period. Also again, most of western Louisville along with parts of south Louisville were at the bottom of the pack with increases in their neighborhood medians of less than $20,000 – or even less than $10,000.

Figure 3, showing percentage increases, paints a different portrait of neighborhood health. Now, the darkest neighborhoods encircle the downtown – including the low-value western communities. Many of these communities experienced appreciation rates over
60% – or even, in a few cases, 100 or 200%. The most extreme cases were in neighborhoods with policy interventions. The high-value suburban neighborhoods, when portrayed by percentage increases, are now near the bottom with modest increases below 40% in most cases. Some outer suburbs and parts of the southern areas saw appreciation rates well below 30%. These maps visually display the context in which our further quantitative analyses take place.

We calculated descriptive statistics for all dependent and independent variables. Descriptive statistics are presented in Table 2. Descriptive statistics in Table 2 show an average median assessed value in 2000 of $89,870 and, in 2006, of $118,106; an average raw dollar change in the median between 2000 and 2006 of $28,236; and an average percent change in the median between 2000 and 2006 of 35.5%. Table 2 also shows descriptive statistics for the independent variables. Median income for the community as a whole is around $40,000. The average tract has nearly 40-year-old housing stock with a construction rate of about 7.5% over the seven-year period. See Table 2 for additional data on the characteristics of Louisville neighborhoods.

Specifications 1–4: Median Assessed Residential Property Value, 2006

Regressions results for the eight specifications across the three models appear in Table 3. All specifications appear side-by-side with all significant predictors (0.10 level and up) shown in italic typeface for ease of comparison. We focus our discussion on the significant variables in each model specification. Based on the adjusted $R^2$ percentage, the independent variables explain between 61.5% (specification 1) and 89.2% (specification 4) of the variation in median values. The number of significant variables ranges from five (specifications 1 and 3) to seven (specifications 2 and 4). In terms of accessibility variables, Adjacency to the Airport was negative in all specifications, as expected, and significant in specification 3 and 4 once we added median income to the model. We
### Table 2. Descriptive statistics.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Standard deviation</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median Assessed Residential Property Value, 2000 ($)</td>
<td>89,870</td>
<td>80,665</td>
<td>48,538</td>
<td>237,715</td>
<td>17,795</td>
<td>255,510</td>
</tr>
<tr>
<td>Median Assessed Residential Property Value, 2006 ($)</td>
<td>118,106</td>
<td>105,000</td>
<td>61,147</td>
<td>301,640</td>
<td>32,125</td>
<td>333,765</td>
</tr>
<tr>
<td>Dollar Change in Median Assessed Residential Property Value, 2000–2006</td>
<td>28,236</td>
<td>23,535</td>
<td>16,275</td>
<td>76,985</td>
<td>8900</td>
<td>85,885</td>
</tr>
<tr>
<td>Percent Change in Median Assessed Residential Property Value, 2000–2006</td>
<td>35.5%</td>
<td>30.5%</td>
<td>22.9%</td>
<td>230.8%</td>
<td>10.2%</td>
<td>241.0%</td>
</tr>
<tr>
<td><strong>Accessibility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacency to the Airport (Dummy)</td>
<td>0.04</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Location Inside the Inner Beltway (Dummy)</td>
<td>0.40</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Employment Density, 2000 (per square mile)</td>
<td>1590</td>
<td>994</td>
<td>2163</td>
<td>18,308</td>
<td>10</td>
<td>18,318</td>
</tr>
<tr>
<td><strong>Demographics/socio-economics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Density, 2000 (per square mile)</td>
<td>3951</td>
<td>3497</td>
<td>2.5E3</td>
<td>11,166</td>
<td>65</td>
<td>11,231</td>
</tr>
<tr>
<td>Proportion of Non-White Residents, 2000</td>
<td>24.8%</td>
<td>10.7%</td>
<td>29.1%</td>
<td>98.1</td>
<td>1.4</td>
<td>99.4</td>
</tr>
<tr>
<td>Proportion of Same-Sex Households, 2000</td>
<td>0.54%</td>
<td>0.48%</td>
<td>0.50%</td>
<td>2.36%</td>
<td>0</td>
<td>2.36%</td>
</tr>
<tr>
<td>Median Household Income, 2000 ($)</td>
<td>40,951</td>
<td>37,561</td>
<td>19,387</td>
<td>104,386</td>
<td>6086</td>
<td>110,472</td>
</tr>
<tr>
<td>Unemployment Rate, 2000</td>
<td>5.9%</td>
<td>4.1%</td>
<td>5.3%</td>
<td>31.6%</td>
<td>1.1%</td>
<td>32.7%</td>
</tr>
<tr>
<td>Crime Level, 2004 (property &amp; violent crime; categorical)</td>
<td>2.57%</td>
<td>2%</td>
<td>1.05%</td>
<td>4%</td>
<td>1%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage Change in Number of Housing Units, 2000–2006</td>
<td>7.5%</td>
<td>2.0%</td>
<td>18.8%</td>
<td>179.7</td>
<td>−29.6%</td>
<td>150.1</td>
</tr>
<tr>
<td>Median Housing Age, 2000 (years)</td>
<td>38.8</td>
<td>39.0</td>
<td>15.2%</td>
<td>58</td>
<td>2%</td>
<td>60%</td>
</tr>
<tr>
<td>Proportion of Housing Units Vacant, 2000</td>
<td>6.4%</td>
<td>4.9%</td>
<td>3.9%</td>
<td>17.3%</td>
<td>1.8%</td>
<td>19.1%</td>
</tr>
<tr>
<td>Proportion of Rental Units, 2000 (%)</td>
<td>35.4%</td>
<td>33.4%</td>
<td>20.8%</td>
<td>90.0%</td>
<td>3.0%</td>
<td>93.9%</td>
</tr>
<tr>
<td><strong>Select public policies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOPE VI Neighborhood (Dummy)</td>
<td>0.01</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>University–Community Partnership Neighborhood (Dummy)</td>
<td>0.01</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Historic Preservation District (Dummy)</td>
<td>0.06</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
Table 3. Comparison of regression results with three dependent variables.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Median Assessed Residential Property Value, 2006 (000s)</th>
<th>Dollar Change in Median Assessed Residential Property Value, 2000–2006 (000s)</th>
<th>Percent Change in Median Assessed Residential Property Value, 2000–2006 (&gt;100)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specification</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Accessibility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment Density</td>
<td>$0.003$</td>
<td>$0.001$</td>
<td>$0.001$</td>
</tr>
<tr>
<td><strong>Demographics/socio-economics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Density</td>
<td>$0.000$</td>
<td>$0.000$</td>
<td>$-0.002$</td>
</tr>
<tr>
<td>Proportion of Non-White Residents</td>
<td>$-0.722^{***}$</td>
<td>$-0.733^{***}$</td>
<td>$-0.150$</td>
</tr>
<tr>
<td>Proportion of Same-Sex Households</td>
<td>$10.511$</td>
<td>$8.435$</td>
<td>$-1.003$</td>
</tr>
<tr>
<td>Median Household Income (000s)</td>
<td>$3.329^{***}$</td>
<td>$3.357^{***}$</td>
<td>$0.760^{***}$</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>$-0.098$</td>
<td>$-0.098$</td>
<td>$-0.663$</td>
</tr>
<tr>
<td>Crime Level (property &amp; violent)</td>
<td>$-31.448^{***}$</td>
<td>$-31.519^{***}$</td>
<td>$-7.161^*$</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage Change in Number of Housing Units</td>
<td>$0.140$</td>
<td>$0.125$</td>
<td>$-0.034$</td>
</tr>
<tr>
<td>Median Housing Age</td>
<td>$-0.788^*$</td>
<td>$-0.821^*$</td>
<td>$0.429^*$</td>
</tr>
</tbody>
</table>

(Continued)
Table 3. (Continued).

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Median Assessed Residential Property Value, 2006 (000s)</th>
<th>Dollar Change in Median Assessed Residential Property Value, 2000–2006 (000s)</th>
<th>Percent Change in Median Assessed Residential Property Value, 2000–2006 (×100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Proportion of Housing Units Vacant</td>
<td>2.737*</td>
<td>2.674*</td>
<td>−0.165</td>
</tr>
<tr>
<td></td>
<td>(0.175)</td>
<td>(0.171)</td>
<td>(−0.011)</td>
</tr>
<tr>
<td>Proportion of Rental Units</td>
<td>−0.439‡</td>
<td>−0.496‡</td>
<td>1.119***</td>
</tr>
<tr>
<td></td>
<td>(−0.149)</td>
<td>(−0.168)</td>
<td>(0.380)</td>
</tr>
<tr>
<td>Select public policies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hope VI Neighborhood (Dummy)</td>
<td>−18.907</td>
<td>−18.907</td>
<td>46.364‡</td>
</tr>
<tr>
<td></td>
<td>(−0.024)</td>
<td>(−0.024)</td>
<td>(0.059)</td>
</tr>
<tr>
<td>University–Community</td>
<td>−30.525</td>
<td>−30.525</td>
<td>10.880</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.039)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>Partnership Neighborhood (Dummy)</td>
<td>−31.265*</td>
<td>−31.265*</td>
<td>27.547***</td>
</tr>
<tr>
<td></td>
<td>(0.122)</td>
<td>(0.122)</td>
<td>(0.107)</td>
</tr>
<tr>
<td>Historic Preservation District (Dummy)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>226.337***</td>
<td>232.338***</td>
<td>−44.589**</td>
</tr>
<tr>
<td></td>
<td>23.095***</td>
<td>19.081***</td>
<td>98.017***</td>
</tr>
<tr>
<td>F</td>
<td>0.615</td>
<td>0.620</td>
<td>0.884</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N (census tracts)</td>
<td>167</td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

Note: Unstandardized coefficients (standardized). Models were tested for multicollinearity with all tolerance scores exceeding .219

***Significance level < 0.001; **Significance level < 0.01; *Significance level < 0.05; ‡Significance level < 0.10 (shown in italic typeface).
suspect that airport noise/air pollution and the boring aesthetics of the surrounding ware-
housing hold down housing values. Inside the Inner Beltway was positive and significant
in specifications 1 and 2, contrary to our expectations given the maps, but not significant
once we controlled for income in specifications 3 and 4. Somewhat recently, many
neighborhoods inside the inner beltway have experienced a renaissance due to proximity
to jobs (at several Fortune 500 companies, four universities, medical centers, etc.) and
amenities (several museums and parks, among others) as well as people’s growing
commitments to sustainability (Ambrosius & Gilderbloom, 2015). This renaissance
could be the reason for the positive coefficient (see also Rypkema, 2003; Savitch,
Tsukamoto, & Vogel, 2008). Employment Density was positive but never significant,
contrary to our expectations – despite the high concentration of jobs in the CBD, several
suburban centers, and at several large area employers.

With respect to socio-demographics, Population Density was negative, contrary to
expectations but compatible with some views that privacy and open space are desirable,
but not significant in any specification of the model. The Proportion of Non-White
Residents had a significant negative effect on median values in specifications 1, 2, and
4 – as expected, supporting past studies on the impact of racial discrimination on house
prices (e.g. Harris, 1999; Yinger, 1986). Median Household Income was positive and high
in significance and magnitude (beta over 1.0) when included in specifications 3 and 4.
Unemployment Rate was negative but not significant in any specification. Crime Level
was significant and negative, consistent with the literature (e.g. Burnell, 1988; Hellman &
Naroff, 1979; Lynch & Rasmussen, 2001), but lessened in impact when income was
present in the model. In other words, income picked up much of the effects of variation in
proximity to downtown, racial composition, and crime.

In terms of housing characteristics, median housing age was negative in specifications
1 and 2 yet positive in specifications 3 and 4 – meaning the significant effect flipped when
income was included. Whereas the findings in specifications 1 and 2 indicate decreased
productivity and more costly maintenance, the findings in specifications 3 and 4 perhaps
indicate a premium or vintage effect. Proportion of housing units vacant was positive in
specifications 1 and 2, contrary to the literature. Similar to median housing age, propor-
tion of rental units was negative in specifications 1 and 2 (consistent with our expecta-
tions) yet positive in specifications 3 and 4 once income was added (contrary to our
expectations).

With respect to public policies, the HOPE VI Neighborhood variable was negative in
specification 2 but not significant. Once income was controlled for in specification 4, this
variable became mildly significant (0.10 level) and positive with a high unstandardized
coefficient of 46.364. This translates into a price differential of over $46,000, comparing
the median in the HOPE VI neighborhood against others that are not, all else equal. Many
HOPE VI neighborhoods – Park DuValle included – are aesthetically pleasing and vibrant
areas, despite the fact that they house lower income residents. Ongoing reconstruction in
Park DuValle further meant that the median value was drastically increasing in the years
since 2000, which may account for this effect. The University–Community Partnership
variable was not significant in these model specifications, as expected given the continued
low value of housing here compared with the expensive suburbs. The Historic
Preservation District variable was always positive and significant, consistent with expec-
tations. The coefficients account for approximately a $30,000 premium in both specifica-
tions, ceteris paribus. These findings are consistent with our observations about
Louisville’s urban renaissance, as discussed earlier. Because we coded the tracts as
containing districts, it in unknown from these results what the effect of designation is
versus the spillover effect. However, it is clear that the history present in these tracts distinguishes them from all other neighborhoods by a significant dollar amount equal to nearly one-third of the median value for all of Louisville.

Specifications 5–6: Dollar Change in Median Assessed Residential Property Value, 2000–2006

The $R^2$ statistics for this model explain between 53.2% (specification 5) and 61.2% (specification 6) of the variation in dollar (thousands) increases in median values. Despite the still high explained variation, the number of significant variables is much lower ranging from two (specification 5) to four (specification 6). None of the variables that fall into the accessibility category were significant in any specification. Of the socio-demographic category, only median household income was significant and positive, consistent with our expectations and the literature, and again with a powerful magnitude (beta nearing 1.0). In the housing category, only the proportion of rental units was significant yet positive, inconsistent with our expectations and the literature. With respect to the policy interventions, the HOPE VI Neighborhood and Historic Preservation District variables were again positive and significant, consistent with our expectations. The coefficient of HOPE VI Neighborhood signifies a nearly $50,000 difference between the median here and the median of all other neighborhoods, all else constant. This nearly identical coefficient to specification 4 shows that the premium in the median is due to changes over the studied seven years. The coefficient of Historic Preservation District indicates an $18,097 difference in appreciation between these neighborhoods that contain a district and those that do not. University–Community Partnership was again not significant when included in this dollar increase model.

Specifications 7–8: Percent Change in Median Assessed Residential Property Value, 2000–2006

The $R^2$ statistics for this model explain between 34.9% (specification 7), the lowest yet, and 71.1% (specification 8), the second highest of the complete models (when compared with specifications 4 and 6), of the variation in percent increases in median values. The number of significant variables was much higher in these specifications than the dollar increase model, ranging from five (specification 7) to seven (specification 8) – on par with the neighborhood hedonic model predicting median values.

In the accessibility category, only Inside the Inner Beltway was significant and positive in specification 7, adding nine percentage points to appreciation, consistent with our expectations about Louisville’s downtown renaissance. Employment Density was the only significant, in this case positive, predictor in specification 8, consistent with our expectations. In the socio-demographics category, Proportion of Non-White Residents was significant yet positive in specification 7, contrary to expectations, while Unemployment Rate was significant yet positive in specification 8, also contrary to our expectations. In the housing category, the percentage change in the number of housing units was significant and positive in both specifications, consistent with our expectations. Median Housing Age was significant and negative in specification 7, indicating a discount for older homes often requiring costly maintenance and updates. Proportion of Housing Units Vacant was significant yet positive in both models, inconsistent with the expectation. Finally, Proportion of Rental Units was negative, consistent with the anticipation, in both models but significant in only specification 8.
All three of the select public policies dummy variables were significant and positive in specification 8. Their inclusion nearly doubled the explained variation of the model, signaling that they must be controlled for to account for the extreme appreciation in some downtown tracts. The percent change in the median was 195 points higher (nearly doubled) in the HOPE VI neighborhood than elsewhere, all else equal. In this model, the University–Community Partnership neighborhood was significantly distinguished from other neighborhoods by 58 percentage points, holding other variables constant. Finally, the neighborhoods containing Historic Preservation Districts saw appreciations 16 points higher, ceteris paribus.

As we progress from the more-traditional neighborhood dependent variable, median housing value, to a model capturing contemporary housing dynamics through percentage increases, we found that the most significant difference is the loss of the predictive power of median household income. This signifies that when using percent changes as the indicator of housing dynamics, the effects of historic forces – which have long held down housing values in neighborhoods with “urban” characteristics like high vacancy rates, minority proportions, and crime levels and lower socio-economic status – were minimized or eliminated over the housing bubble. Furthermore, as we compare across the models, we saw that the effect of having a policy intervention within a neighborhood – whether through an external infusion of capital or through legal restrictions governing historic properties – emerged when one models recent percentage increases in addition to traditional median values and dollar increases.

**Policy implications**

In this study we analyzed three public policy interventions: (1) HOPE VI; (2) a University–Community Partnership; and (3) Historic Preservation Districts. This present study confirms previous findings that Louisville’s HOPE VI neighborhood saw large percentage increases in assessed values over our analysis period (Ambrosius et al., 2010). Compared with other neighborhoods, the median for the neighborhood containing the HOPE VI redevelopment nearly doubled with an increase of almost $50,000 in the years between 2000 and 2006. We assume that this estimated increase – which is net other factors controlled for by the models – can be attributed to neighborhood improvement through demolition, reconstruction, and the positive spillover effects. Park DuValle went from being a distressed area to a vibrant, aesthetically pleasing, and walkable community. It remains to be seen whether the newly built units will continue to increase at this extreme level or whether they will revert to previous low levels of property appreciation. Other research has found that this trend continued into at least 2008 and unpublished findings suggest that similar patterns hold up to the recovery period around 2010 (Ambrosius et al., 2010).

Location in a University–Community Partnership neighborhood was insignificant in most models with the exception of specification 8. The location in such a neighborhood resulted in a percent increase in the median assessed value of almost 60 points. This probably signifies that the partnership and its associated investment raised this once-distressed neighborhood to be on-par with other communities. This drastic, positive increase over the housing boom is missed by reports such as those by the GLP that promote neighborhood assessments based on raw dollar increases which, in some cases, are poor indicators of policy success.

Consistent with the previous literature, we posit that historic preservation is a public good that has a consistent positive effect on neighborhood housing values (Gilderbloom...
et al., 2009). Urban historic district tracts not only have seen contemporary increases, but residential values there are about $30,000 higher in absolute terms, with about $18,000 in recent increases, than in comparable tracts. Appreciation in these neighborhoods containing districts was about 16 percentage points higher than in other neighborhoods, holding other factors equal. We believe that the designation of an already historically valuable community as an urban historic district will consistently produce positive increases in neighborhood values, compared to suburban and non-designated urban neighborhoods, in the foreseeable future due to strict protections of the unique historical features of Victorian (and other) homes which cannot be replicated today. Policy-makers wishing to bolster neighborhood housing markets should consider measures such as historic designation which are relatively inexpensive to municipalities compared with other costly interventions to revitalize or recreate a community’s housing stock. These designations may not directly benefit potential homeowners or tenants in terms of present appreciation, but there are additional benefits such as job creation due to designation that could benefit them (Gilderbloom et al., 2009).

As a methodological issue, this paper reveals how housing analysts and advocates can better discern value changes partially attributed to policy interventions. Models predicting recent changes – dollar or percent – may find a significant difference from interventions that would go unnoticed in a more traditional, median-only model. Advocacy groups that look at neighborhood changes, like the GLP, should publish percentage changes in addition to raw dollar changes to better convey recent neighborhood housing market performance. There is a greater tendency to see significant impacts if the dependent variable is measured as a percentage change. This operationalization of the variable is key in determining whether contemporary conditions and policy interventions have significantly shaken up the effects of traditional predictors of housing value. Low and modestly priced neighborhoods might not experience the largest dollar increases but in our analysis, these neighborhoods often experience larger percentage increases. Reporting percentage increases in think-tank reports and media accounts, such as Green (2007), can help to alter investors’ apprehensions about investing in “hot” urban neighborhoods that nonetheless have lower median values than suburban counterparts. A higher rate of return on an investment that requires less money down should be a desirable prospect for investors in residential housing.

We document that neighborhoods with non-White populations, vacant housing, and high crime – which can be thought of as typically “urban” conditions – did not deter investment over the bubble and may even attract investment because the properties may be historic and located near the CBD or other high employment areas. Although the original focus of this paper was on measuring policy interventions with percentage changes, an unexpected finding was how the racial composition in neighborhoods is a non-factor (or even positive factor) in contemporary value changes. While majority African-American neighborhoods in Louisville certainly still have lower median values overall, this finding challenges the conventional view that minority neighborhoods produce lower returns on investment. Surprisingly, the Proportion of Same-Sex Households was the only variable to not attain statistical significance in any specification for any model. It may be that this “trendy” variable’s effects were instead captured by other urban or socio-economic indicators – such as Inside the Inner Beltway, Median Household Income, or Historic Preservation District, for examples.
Conclusion

The essence of science is rigor, replication, and responsibility. Using an operationalization that measures contemporary changes has yielded some surprising results that defy conventional wisdom. For example, while we acknowledge that non-Whites historically had a negative impact on neighborhood housing values, our contemporary analysis using percent changes reveals that race did not negatively impact current changes over these seven years. Moreover, location in historic and older neighborhoods was shown to have a positive impact using percentage changes. Similarly, policy interventions which are discounted as ineffective by a more traditional analysis were shown to have a positive impact on contemporary values.

Using different operationalizations of the median housing value dependent variable yielded divergent results in the regression models. Our analyses for Louisville Metro over the time frame 2000–2006 show that the effects of our four classes of independent variables vary when tasked with explaining median values, dollar increases, or percentage changes. As our maps showed, this discrepancy between the models and the variables’ effects was to be expected. For example, while low and modestly priced neighborhoods might not experience large absolute dollar increases, they may nonetheless experience larger percentage increases. Clearly, the independent variables are impacting these dependent measures – which can be seen as an expenditure function (raw dollar change) or a standardized variable (percentage change) – differently, a notion confirmed by our models.

Analysts and advocates tasked with estimating neighborhood-level impacts on housing values should capture contemporary market conditions by analyzing percent changes, or other standardized appreciation rates (see Kim, 2000), so that they adequately estimate current effects rather than those shaped in large part by the forces of the distant past (i.e. median valuation). At a minimum, percent changes should accompany any raw dollar analysis in fairness to capturing the effects of recent social shifts and policy interventions. Research on neighborhood housing markets played a role in reinforcing racial stereotypes and, at times, discredited targeted policy interventions as ineffective. We show that using contemporary percentage changes gives a more accurate assessment of government programs than raw dollar increases alone. We suggest that both measurements should be used in studies of housing policy interventions – otherwise a conventional measurement alone could constitute statistical mismeasurement, to borrow the late Stephen Jay Gould’s powerful term (Lewis et al., 2011). We hope that our analysis leads to a rethinking of contemporary neighborhood housing dynamics by academics and policy advocates alike.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes

1. This map is recreated as Figure 2, referenced later, using 2000–2006 dollar increases. Future annual reports released by the GLP, up to 2013, do not include comparable maps or data on the local housing market. This presumably reflects their desire to focus more on other types of indicators, including education, health, and technology.

2. Gilderbloom and Appelbaum (1988, p. 95) pioneered the idea that urban regions analyzed in housing studies should be “relatively self-contained housing markets, free from the effects of adjacent market areas.” They studied only monocentric cities that were at least 20 miles from
the nearest large central city over 50,000. Louisville’s larger distance to nearby major cities nearly quadruples this modest distance, making its housing market much more geographically autonomous than those in megalopolitan regions.

3. Several of Louisville’s peer cities identified by GLP are also consolidated, including Indianapolis, IN, Nashville, TN, and Jacksonville, FL.

4. Other local advocacy organizations such as the Metropolitan Housing Coalition release reports based on analyses at even higher levels of aggregated geography, including Metro Council districts and ZIP codes, which do not approximate neighborhoods (e.g. Metropolitan Housing Coalition, 2008, which studied the impact of the foreclosure crisis in Louisville).

5. Three tracts (003000, 004900, and 011901) were removed from analysis due to an insufficient number of residential units, a common practice for Louisville housing studies (Ambrosius et al., 2010; Bourassa, Cantoni, & Hoesli, 2008; Gilderbloom et al., 2012; Gilderbloom, Hanka, & Ambrosius, 2009, 2012; Greater Louisville Project, 2007). Tracts 00300 and 004900 comprise the CDB, respectively, and have seen a very recent significant rise in residential development – although some of these homes are still coded as commercial by the Jefferson County PVA (as of 2006). Tract 011901 includes the airport and its surrounding commercial district, both of which were expanded very recently, thereby destroying a large portion of the housing stock in this particular census tract. This tract also includes the fairgrounds/exposition center and a theme park.

6. We also ran regression specifications with Distance to the CBD in place of the Location Inside the Inner Beltway variable (not shown) to capture proximity to the downtown in a traditional, linear fashion (Ambrosius et al., 2010). In this present analysis, we chose instead to compare the submarkets traditionally labeled “urban” with those recognized locally as “suburban,” including both inner and outer rings. The tracts labeled Inside the Inner Beltway do not perfectly align with the old city boundaries but follow Louisville Metro’s own designation of the new urban submarket (Louisville-Jefferson County Metro, 2006).

7. Our approach may be viewed by some as a limiting factor for our models.

8. We estimate that these positive changes have resulted in a housing stock that is approximately one-quarter gentrified.

Notes on contributors
Matthew J. Hanka is an Assistant Professor of Political Science and Director of the Master of Public Administration program at the University of Southern Indiana, Evansville, IN. His research interests include housing policy, community development, urban policy and governance, social capital, and historic preservation. His work has been published in American Review of Public Administration, Community Development, Housing Policy Debate, Journal of Urban Affairs, Journal of Urbanism, Local Environment, and Planning for Higher Education.

Joshua D. Ambrosius is an Assistant Professor in the Department of Political Science and Master of Public Administration Program at the University of Dayton. His research interests include urban and housing policy, regional governance, and religious organizations. His academic work has appeared in such journals as Journal of Urban Affairs, Housing Policy Debate, American Review of Public Administration, Journal of Urbanism, Local Environment, and Interdisciplinary Journal of Research on Religion.

John I. Gilderbloom is a Professor in the Graduate Planning, Public Administration, and Urban Affairs program at the University of Louisville, where he also directs the highly lauded Center for Sustainable Urban Neighborhoods (http://sun.louisville.edu). He is also a Fellow of the Scholars Strategy Network under the direction of Professor Theda Skocpol at Harvard. In an international poll of thousands of urbanists, planners, and architects, Professor Gilderbloom was ranked one of the “top 100 urban thinkers in the world.”

Keith Wresinski received a BA in Geography and a GIS Certificate from the University of Missouri. He then worked toward a Masters in Planning at the University of Wyoming and is currently a Research Assistant and PhD student in Urban and Public Affairs at the University of Louisville. His primary skills are in the areas of geographic information systems (GIS) and econometric modeling.
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